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Measuring Enterprise Architecture

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SUPERVISOR'S APPROVAL

MEASURING ENTERPRISE ARCHITECTURE

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This report was prepared under the supervision of the project supervisor, Prof Madya Aishah Ahmad. It was submitted to the Faculty of Computer and Mathematical Sciences and was accepted in partial fulfillment of the requirements for the Bachelor of Information Technology (Hons) Information Systems Engineering.

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31 JANUARY, 2016

STUDENT'S DECLARATION

I certify that this report and the project to which it refers is the product of my own work and that any idea or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.

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ABSTRACT

Enterprise Architecture (EA) is an investment for organizations as it is beneficial for them. Therefore measuring is needed to be done in order to realize the EA benefits. In Malaysia, EA is relatively a new initiative for Malaysian organization to be able to compete with other organizations in order to sustain in dynamic business environment. Organizations believe that by adopting EA in their organization will help them in aligning their business process with IT. Therefore the worth of EA that is said to be delivered needed to be measured. Although the measurement is considered as one of the important evaluation needed to be done, there are not many is done in Malaysia on reasons of the limitation in EA knowledge and the acceptance of changes by employees. Case study in this research is carried out in the Ministry of Finance Malaysia (MOF) where the process of the implementation is based on their business process aligning with IT and it is not done entirely according to the theory of EA implementation. An interview session is conducted with the Business Relationship Manager (BRM) in MOF who is responsible in ensuring the information regarding EA implementation and the EA concept is understood in the organization. The data gathered assisted in identifying measuring elements that visualize the worth of the EA value. The elements are classified according to four benefit indicators; communication value, strategic value, tactical value, governance value. A draft of an evaluation model is constructed based on the literature reviewed. Measuring elements for MOF are generated after analyzing data that have been gathered from the interview session. The elements are then mapped onto the draft of the evaluation model constructed earlier. As a result, a synthesized model for measuring EA is constructed. There are limitations faced when conducting this research. However, this research will only focus on classifying measuring elements according to the four benefit indicators mentioned. By classifying these elements will assist academician as well as practitioner in measuring EA. For future work, it would be recommended for the measuring elements in the synthesized model of MOF to be used in measuring EA in MOF.

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LIST OF ABBREVIATIONS

BSC	Balanced Score Card
BRM	Business Relation Manager
EABOK	Enterprise Architecture Body of Knowledge
EA	Enterprise Architecture
IT	Information Technology
MAMPU	The Malaysian Administrative Modernisation and Management and Management Planning Unit
MOF	Ministry of Finance
TTP	Treasury Transformation Program

CHAPTER 1

INTRODUCTION

This chapter provides the background and rationale for the study. It also gives details of the significance of measuring Enterprise Architecture (EA) and the issues and problems that led to the study.

1.1 Background Study

According to Oxford (2015) dictionary, measuring ascertains the degree of something by using an instrument or device marked in standard units where it can be understood as setting a benchmarked that defines the level of how good whatever is measured, example, the performance of an organization aligning with the organization's mission, vision as well as goal. It can be represented in the form of a framework, model or graphical representation. Various aspects can be measured in order to identify what does the organization needs to improve in order to achieve its goals. The aspects that can be measured are the organizations' processes, performances, effectiveness, efficiency, and value (Niemi (2008); Morganwalp and Sage (2004))

As described in Center on the Developing Child (2015) that in education components of evaluation are the research design and the specific measures, such as questionnaires, instruments, tasks and neuropsychological measurements, that will be used to assess participants about the effect of a particular intervention. Different sets of evaluation tools may be necessary depending on what needs to be measured. This indicates that measurement helps evaluation.

A new initiative in an organization can be measured to indicate success in achieving its objective by strategically measuring the alignment with organization's mission, vision as well as goals (Blosch, 2013). Enterprise Architecture (EA) is a strategic process that translates an organization's business vision and strategy into effective enterprise change (Buchanan, 2010). It is a discipline for organizations in response to the breakthrough that transforms them by identifying and analyzing the execution of change towards desired business vision, mission and goal (Blosch, 2013).

In the past two decades, EA has gained popularity in Malaysia as one of the key initiatives driven to make the organization survived the business change (Rafidah Abd. Razak, Zulkhairi Md. Dahalin, Rohaya Damiri, Siti Sakira Kamaruddin, & Sahadah Abdullah, 2007). EA is "the glue" between business strategy and IT strategy that allows them to drive each other (Opt, Proper, Waage, Cloo, & Steghuis, 2008). Enterprise Architecture bridges the gap between those decision makers who come up with new strategies and objectives and those who are involved in enterprise transformation and investments in change. It is about what the enterprise can do now (baseline capabilities) and what it wants to be able to do in the future (target capabilities). EA gives a holistic view of the organization which covers on their processes, information technology that drives the alignment of the business and IT in a structured and more efficient way (Aziz, 2005). EA as being described by Bernard (2012) is what integrates the components of the organization; business, strategy and technology.

In 2011 (Razak, Dahalin, Ibrahim, Yusop, & Kasiran) did a survey on 100 organizations and discovered that the fast changes in information technology drive every organization to compete among them in order to survive in the business world. Through EA the organization is able to compete in global competition by executing successful business models. However, when EA is perceived as an investment, the high expenditure on the investment comes together with an increasing demand to measure the business value of the

investment. It is mandated for a measurement of its value to be carried out to measure the worth of time, money and effort on the investment.

EA can be measured in many ways in order to prove their worth (Cameron, 2011). Tools such as metrics, framework, and models are used to measure EA where it can used to illustrate the effective success or failure of EA. One of the tools being used in measuring EA is Balanced Score Card (BSC). The concept of BSC is providing guidance on where to identify and quantify the value of EA. This will assist practitioner to design and implement suggested framework (Schelp, 2007).

The data that is used in this research is collected from the Ministry of Finance Malaysia (MOF). EA is currently being implemented within the ministry. Based on a class visits to MOF (19 April 2015), it is understood the exposure of EA among the people who are involved in implementing EA is rather vague. EA in MOF is initiated by the top management. This is because they acknowledge with the benefits that EA provides by implementing it within organizations. EA also emphasize in aligning business with current technologies. EA concept attract the top level management, hence with support from the ministry they initiate the implementation of EA within MOF.

However the top management and the one responsible in executing EA learn and understand EA during the implementation and EA practice. Their knowledge in EA as well as their EA practice are inadequate hence, creates gap between what EA should be and what current EA are in the ministry. In order to minimize the gap in MOF, the elements that indicate EA benefits need to be identified so that EA benefits can be realized. Their EA benefits can be realized by measuring the effectiveness of their EA. Therefore, from the elements identified, their EA can be measured accordingly in order to value the worth of EA in MOF. The results of the measurement will also assist them in executing their EA practice in next measurement.

1.2 Problem Statement

EA promises to be the bridge between the business and IT domains (Abd Razak, 2008) where it can fulfill the growing need and to manage increasing complexity and deal with dynamic changes by providing holistic view of the organization. Therefore with such benefits EA has gained popularity in Malaysia. With EA still new in Malaysia, not much is known by the managers of the content of a well-documented architecture which is a logical information regarding their business rules, objectives strategies and strategic goals (Abd Razak, 2008).

One of the major concerns is the failure of many enterprises to actually measure the value of their current or baseline Enterprise Architecture. One is reminded of the old adage 'What you don't measure, you can't manage'. When changes occur as a result of new strategies and target enterprise models, the subsequent enterprise transformation may well be many months or years into the future. Changes are delivered by other groups inside the enterprise or external solution delivery partners. If measures and metrics are not used and actively managed then it becomes rather difficult to compare the old baseline with the new baseline to see what value has been achieved. Therefore, measuring the EA within the organization has to be done as to create awareness in terms of lessons learnt, pitfalls and contributing factors and benefits (Razak, Dahalin, Dahari, Kamaruddin, & Abdullah, 2008) of EA as well as to improve and better prepared for EA maintenance.

From the interview conducted with Business Relation Manager (BRM) from MOF, measurement takes place in MOF is always being measured because EA is constantly changing from time to time. The evaluation is carried out by Treasury Transformation Program (TTP). In MOF, according to the BRM "...the results of their current evaluation are identifying the effectiveness of their initiatives to current need of MOF. According to their current evaluation the value of EA is not being acknowledged, hence the worth of their EA cannot be seen in MOF."

The set of possible measurements for EA is very large (Zhu, 2013). This is partially because EA is considered as the glue between strategy and execution. Thus, the main principle is: Focus on outcomes, "beginning with the end in mind" (Carcasson, 2009). Generally speaking, EA benefits indicators can be grouped into four categories (Tamm, Seddon, Shanks, & Reynolds, 2011): communication value, strategic value, tactical value and governance value. The four benefit indicator is focused on in this research because the value it represent able to measure the worth of EA to MOF.

1.3 Research Aim

To construct an evaluation model for measuring EA value based on the four benefit indicators: communication, strategic value, tactical value and governance for MOF EA practice to assist in its next evaluation exercise.

1.4 Research Objectives

Based on the four indicators of communication value, strategic value, tactical value and governance value the research objectives are:

I. To draft an evaluation model for measuring EA from literature.
II. To gather data and analyse EA measurement in MOF.
III. To synthesises and construct evaluation model for measuring EA value in MOF.

1.5 Research Significance

Enterprise architecture can produce a large variety of tangible and intangible results hence study will focus on the stakeholders and their concerns, and the decisions that should be taken based on these results.

- **To practitioner**

  To give clear view of EA for the organizations in order to create awareness to practitioner in identifying the right elements of EA to be measured in order to fully realized the EA benefits according to its indicator which are communication value, strategic value, tactical value and governance value.

- **To researcher**

  Enhancement in the foundation of understanding on EA benefits indicators for measuring EA.

1.6 Research Outline of the Thesis

This report is organized in the following way where this section shows the flow of the project and the relationship of every chapter.

Chapter 2:
This chapter elaborates and discussed more in depth about related topics of the research and case study on measuring EA in organization.

Chapter 3:
This chapter discussed on the method to achieve the objectives of this research.

Chapter 4:
This chapter discussed about the data findings from the case study and the evaluation carried out in the organization based on the four benefit indicators. The result is an evaluation model for MOF concentrating on the four benefit indicators: communication value, strategic value, tactical value and governance value.

Chapter 5:

The conclusion of the thesis places the findings in a larger context. The evaluation model can be used by any organization practicing EA. The chapter also draws on the limitations and future recommendations of the research.

CHAPTER 2

LITERATURE REVIEW

The previous chapter provides an overview of the state of the literature related to the measuring of Enterprise Architecture (EA). This chapter extends the previous chapter by reviewing the literature relevant to both measuring and EA. This chapter ends with a summary of the literature.

2.1 Measures

The result of measuring can be a constructive criticism if the one being measured perceived it in a positive way. As human being, we are always being criticized by the people around us. Although being criticized is not the ideal way of living, but it is the only way for us to reflect on ourselves and improve in becoming a better person as a whole. Perceiving criticism as a constructive mechanism is important as Aristotle once said "To avoid criticism say nothing, do nothing, be nothing" (Goodreads, 2015) and the one who criticized is not necessarily people who want to condemn us, but actually helping us. Quoted from Abraham Lincoln "He has a right to criticize, who has a heart to help." (Goodreads, 2015).

Measure as defined in the Dictionary (2015) is to estimate the relative amount, value of something by comparison with some standard. The aspect of measuring can be seen in our everyday life. For example a lecturer marking students' paper after final examination in order to grade them whether they pass or otherwise. When marking the final paper, the comparison will be made with the schema of the syllabus that already been taught during class for that particular semester. With the result of the total grade of the students, a statistic will be made accordingly. From the statistic it will concluded a final view on the students' grade regarding the particular subject. Hence,

improvement can be made based on the statistic as to what need to be improve, what need to stay and to be remove. Therefore, in every aspects being measured, there are importance to it.

2.1.1 Measuring in Organization

Every organization established has their specific goals that need to be achieved within the time frame set by the organization itself. By measuring the organization it will support the development goal of maximizing the results of the business process (Davenport & Short, 2003).

One of the benefits in measuring is that it will contribute knowledge of what elements that can strengthen the organizations. Knowledge gained give purpose for the organization in doing measures for their business process. The purpose is where the results of the measures can create awareness for the stakeholders to be used in order to improve the organizations' measures in the future (Parhizgari & Gilbert, 2004).

The time for measurement depends on the organization on when to carry out the measuring. It depends on where is the project in the Software Development Lifecycle (SDLC). The elements that need to be measured differ for different phase. Furthermore, the measuring purpose depends on the one who responsible in carrying out the measurement as different position in the organization have different interest when doing the measurement (Ishigaki, 2004)

It is crucial to know the information needed when designing for measures. The information needed is defined by the organization, project, team, objective, issues and risks (Ishigaki, 2004)

2.1.2 Measuring Act as a Tool in Assisting Organization

In order for decision makers to monitor key issue related with the organizations' goals, progress they need information that precisely match their requirements. Measurement is considered as an effective management tool (Ishigaki, 2004). How management tool assist measuring an organization is explained in Figure 2.1

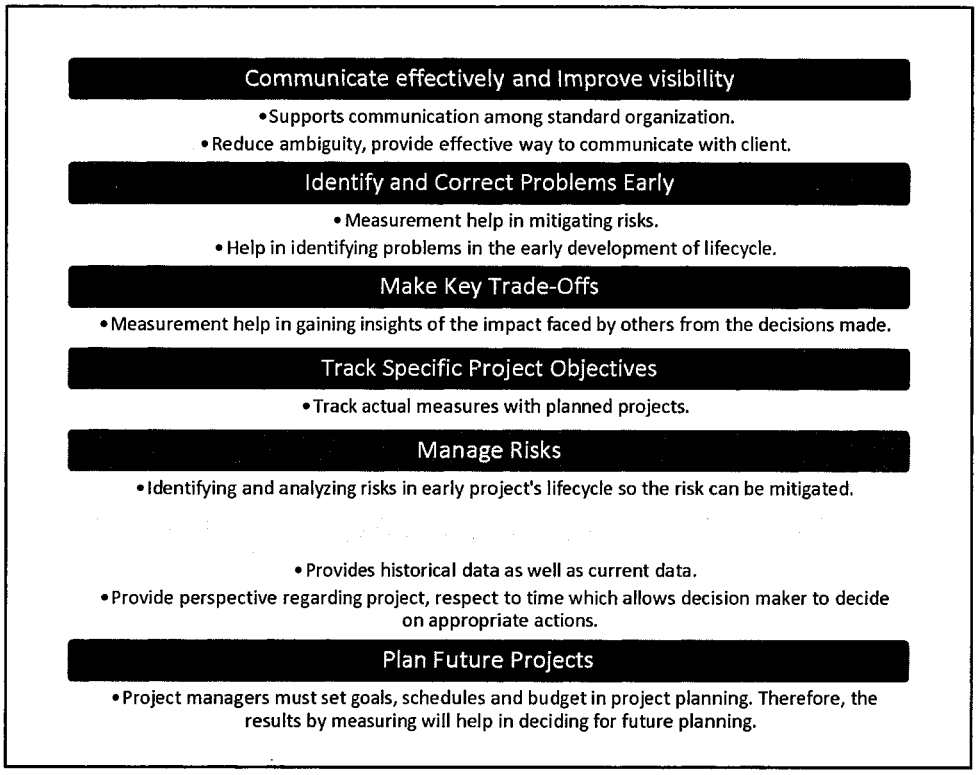


Figure 2.1 Assistance of Measurement Tool (Ishigaki, 2004)

Measurements are learning process for organizations to be better when competing with other organizations especially in this technology where everything evolves so quickly. By measuring, it will help organizations in improving their business activities as well as search for initiatives where the work can be easier and organized. One of the famous initiatives found in making work more efficient is implementing EA within the organization.

2.2 Enterprise Architecture

EA have many definitions to it, as The Open Group's Architectural Framework (TOGAF) defined it with two definitions depends on the usage of EA. First, the detailed plan of the system and the guideline in its implementation at component level. Second is the relation and structure of the components and the principles, governance and guidelines to its implementation (Op't Land, Proper, Waage, Cloo and Steghuis, 2009).

Gartner defined EA as the evolution of the enterprise that can be achieved by changing the communicating, creating and improving the key principles that describe the enterprise itself, by translating the business vision and strategy effectively (Lapkin, Allega, Burke, Burton, Bittler, Handler, James, Robertson, Newman, Weiss, Buchanan and Gall, 2008).

$$\mathbf{EA = S + B + T}$$

Enterprise Architecture = Strategy + Business+ Technology

The equation above provide an overview of the discipline of Enterprise Architecture (EA) (Bernard., 2012). These EA view encompass strategy, business and technology. According to Bernard (Bernard, 2012), EA is a devotion practice of management and technology to improve the enterprises' performance by providing a holistic and integrated view of their strategic direction, business practices, information flows and technology resources. The holistic view that is provided by EA will visualize the way of each element interacts with each other. Thus, will explain on how the changes can affect the organization in reaching their business vision. The management of EA is set of tools that will help with analysis and decision-making. (Dankova, 2009).

It is crucial to have the right definitions of "Enterprise Architecture" in order to have clear understanding of what it is, what does it cover, what are the

benefits from employing EA and what are the results. It is often to have misunderstanding and misinterpretation to the definitions itself thus the benefits of what EA will bring are unambiguous (Lapkin et al., 2008)

2.3 Enterprise Architecture Domain

EA implementation covers four domain of architecture, which are business architecture, information architecture, application architecture and technology architecture. Almost all EA frameworks cover these domains where each domain carries its own function and delivers its results. They also relates with each other in order to realize the EA benefits (Gorazo, 2014). In Table 2.1 explains the purpose of each architecture.

Table 2.1 EA Domains (Gorazo, 2014)

Domains	Purpose
Business Architecture	The organizations' important business process is outlined in this stage as to identify the mission, vision and goal of the organization.
Information Architecture	The ability to access information in the organization in order the EA practice will assist in achieving the goals.
Applications Architecture	The relationship that mapped each components of the organization
Technology Architecture	The alignment of the business process with IT is visualized by using the current technologies identify in this architecture.

How the architecture in the domain relates with each other is that in the business architecture it will identify the organization precisely such as their business strategy, models, processes and services. The elements identified in the business architecture will assist the information architecture in accessing information needed for the organization. It will store all the data required upon the identification done in the business architecture and how they are being stored. In the application architecture, EA will identify the solution to support the business processes by identifying the technology specification required in order to support the business architecture. When the technology specifications are identified in the application architecture, it is then defined in the technology architecture. What it provides is the frameworks, technical patterns and services that support the technology specifications identified in the earlier architecture. It relates with application architecture by setting the standards and defining the strategies for technologies used to develop, execute and operate the application architecture (Aziz, Obitz, Modi and Sarkar, 2005).

2.4 The Roles of Enterprise Architecture

EA is an initiative for organization competing in evolving economy as technology improved from time to time, so does the alignment of it with the organization business process. This resulted in creating new profession in the economy (Strano and Rehmani, 2007). Profession such as Enterprise Architects who responsible in practicing EA activities that will standardize the business process with IT environment (Gorazo, 2014). There are different roles in practicing EA, however each of the roles interact with each other in order to formulate the competencies required in order to perform their roles. Good roles performance will improve the organizational performance and achieve its goal strategically (Strano and Rehmani, 2007).

Some key roles of EA (Gorazo, 2014) are;

i) Developing a technology vision and strategy

In developing the strategy, mission, vision and goal of the organization, it requires people in the top level management. The top level management able monitor the organization with a holistic view therefore they are able to identify any gaps occur as well as be the decision maker to take action in achieving the desired organizational goal.

ii) Methodology lifecycle

The methodology lifecycle act as one of the roles in EA as the methodology developed by the organization should define on the method used in delivering EA results. Lifecycle is defined such as the recommended rapid application development methods.

iii) Information and Data Architecture

Information and data architecture will assist in storing and accessing the information of the organization defined in the business architecture. One of the easiest ways to convey large information is by developing model where the information can be understood clearly without having any misunderstanding of the EA concept and the business process, strategy, mission,.vision and goals of the organization.

iv) Integration Architecture

Integration architecture will define the interrelation of each components identified in each architecture.

One of the benefits that EA provide is having the holistic view of the organization. It is not only technology oriented, it is the integration between both the business as well as the technology. It is dynamic as when the technology changes, the business-IT alignment also need to change. Three

different levels that play a major task are top-management level, middle level and bottom-level. Their perception on EA is crucial as to refrain from having misunderstanding regarding EA. To avoid the 'ivory-tower syndrome'[1], each of the level needs to communicate with each other (Wagter, Van Den Berg, Luijpers and Van Steenbergen, 2005) in order to strive for something of the same result and goals.

2.4.1 Challenges in Roles of EA

Challenges in EA are the buy-in of the stakeholder of EA[2], obtaining the essential resources such as funds to support the project and influencing the project in progress. The stakeholder in EA is the one who proposes EA, implemented EA and impacted by the EA changes. Therefore, it is crucial to share the same understanding on EA concept with the whole level in the organization where in that way the EA benefits can be realized. If the stakeholder does not have the commitment with EA it is nearly impossible to accomplish the desired goal of the organization (Gorazo, 2014).

With three different levels of stakeholder it creates different perspectives (Gorazo, 2014). As described by King Gorazo, the perceptions of EA from stakeholders are the decision making on EA, the delivery of EA and the conformance of EA.

The top management will make the decision making on EA, it involves in approving new changes or products in existing EA products. The decisions then will be deliver by the workers in the organization, they are the one who is impacted with the changes, however the delivery of EA also need to validate whether the decision made conform to EA. This brings to the conformance of EA where it requires the right message and understanding of EA delivery are conveyed among each levels in the organization. This to

[1] Organization leaders spend most of their time with other leaders in the organization or managers focusing on organization's big issues and tend to forget people that carry out the works; people at the bottom of the organizational hierarchy (Leadership Resource Center, 2015).
[2] Buy-in of the stakeholder of EA is their understanding on EA concepts.

ensure the changes being made is complying with the EA policies, provides feedback on the applicability of the EA products (Gorazo, 2014).

2.5 Enterprise Architecture Benefits

EA benefits are rarely documented or compiled into a journal. As each organizations have different understanding on EA deliverables therefor generate different benefits out of the different undertaking on EA itself.

2.5.1 Benefit Indicators

Indicators for specifying benefits of EA in this research is based on (Zhu, 2013)Pearl Zhu (2013) where the value are communication value, strategic value, tactical value and governance value. Each of this value is explained below;

i) Communication value

According to Merriam-Webster Dictionary, communication is the information transmitted. Applying it with EA is information transmitted among the levels and stakeholders as EA is a complex architecture it requires communication among each domain; as mentioned earlier, in order for every changes happen, the changes happen aligning with other domain.

Communication value is the ability of EA to formalize communication of the function in each architecture (Gorazo, 2014) and how to gain the buy-in of the stakeholder on EA. EA can benefit communication value by relating each components of the organization with each other and ensuring no misunderstanding regarding the deliverables of the organization's mission, vision and goals.

ii) Strategic value

EA gives strategy value to organization as the holistic view it provides able to identify elements needed in order to achieve the organizations goals. As Pearl Zhu mentioned, EA is the missing piece in strategy and execution.

EA gives strategic value as strategy defined in Merriam-Webster (2015) is a plan of action designed to achieve a long-term or overall aim. Therefore in EA, strategy plays an important role in keeping align of the business process with IT.

iii) Tactical value

Tactical as defined in Merriam-Webster dictionary is relating to planning of action designed in gaining a desired end or temporary advantage. The tactical value of EA is knowing the purpose of implementing EA which are to better the efficiency of operation in the organization.

iv) Governance value

Governance is the establishment of policies, proper implementation is being monitor continuously by the stakeholders in the organization (Business Dictionary, 2015).

Governance value covers the view that EA provides which is a holistic view. The governance value able to responds to any changes or deviations in architecture and expectations. Governance includes processes, activities and products that relate to monitoring the organization business processes. Governance also maintains the alignment of the business process with IT.

2.6 Enterprise Architecture as an Investment

According to John Zachman (Zachman, 2001), the cost of EA is not suitable to justify as the value that it brings are the alignment, integration, change. Which are more in gaining understanding and knowledge regarding the alignment of IT with the business process that can be achieve by creating relationship between each of the departments in the enterprise and adapt with the changes that happen due to aligning with IT. These values are time consuming in order to see the end-result. Hence, it resulted with low understanding among people. As common perspective that is instil in the community is the idea of "Cost-Justification" that came out of the Industrial Age. An idea where "better, faster, cheaper" is the value that will replace people cost with computer cost which is cheaper, faster and resulted to be better (Zachman, 2001).

Although the cost of EA may not be justified, it is considered as an investment, because it is an asset where an infrastructure that can be use more than once (Zachman, 2001). Adopting EA will enable the enterprise to do what it unable to do without architecture which are alignment, integration, change and reduced "Time to Market" (Zachman, 2001).

Same goes to the business world where the expectation of high Return on Investment (ROI) is a norm in something that is being invested in. Thus, when an enterprise adopts EA, the ROI are the knowledge, assistance in analysis and decision making as well as clarifying thinking (Brown, 2004). Based on the study that is conducted by Tony Brown (Brown, 2004), the values that EA brings are shown Figure 2.2.

With the value that EA brings, unfortunately it will not reduce cost but still able to provide an impressive ROI (Brown, 2004). EA is said to be an investment as the cost and time taken for adopting it will bring benefits and add value to the enterprise.

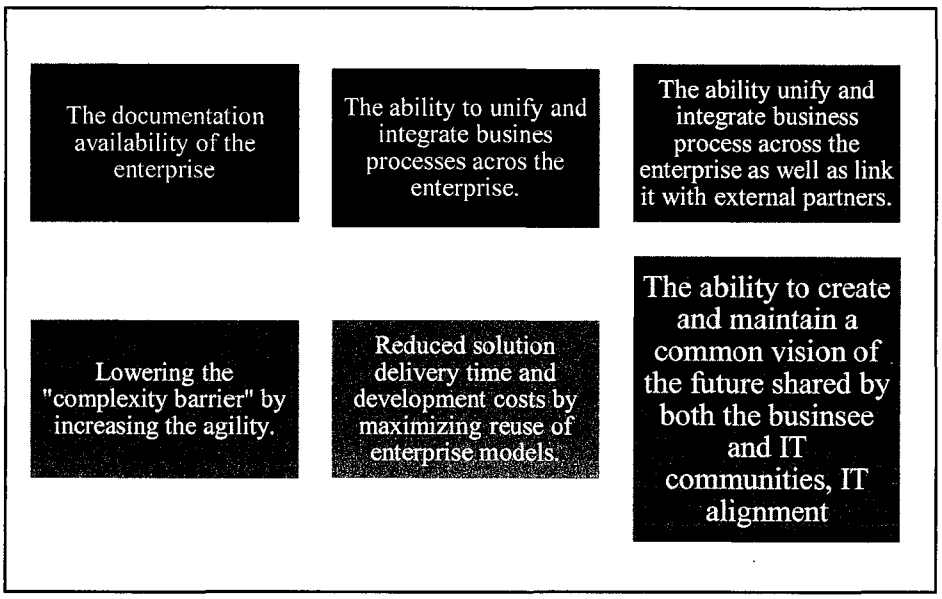


Figure 2.2 EA value

(*Sources*: Brown, 2004)

2.7 Enterprise Architecture Implementation

EA need to be implemented within an organization that wishes to benefits what EA provide. By implementing EA, the organization able to see how the implementation methodology defines EA being implemented and how the documentation will be developed, archived and used. This include with the selection of framework, modeling tools and on-line repository. With the holistic view that is provided by EA, the implementation methodology documents the "as-is" and "to-be" views of EA that is strategically aligned with the organization's goals.

In order to establish an EA program and implement the EA documentation elements, usually it will follow a four phase methodology.

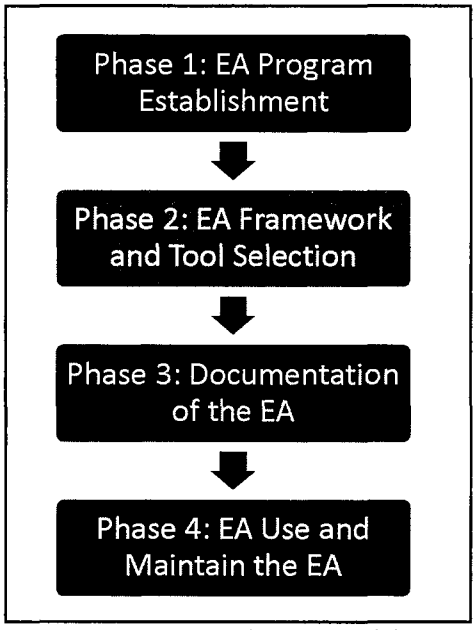


Figure 2.3 Four Phase Methodology:

- Phase 1: EA Program Establishment

  It is the most crucial phase out of all the four phases. This is because during this phase it will identify the EA main people; the one who responsible in implementing EA, who is affected by the changes of implementing EA, the sponsor of implementing EA.

  The EA management program is established and identifying chief architect; the role of a chief architect vary widely from one organization to the next (Mar, 2012). Other than that, EA implementation methodology, EA governance that links to other management processes. Furthermore, this phase will create a communication plan that eventually will gain stakeholder's trust

- Phase 2: EA Framework and Tool Selection.

  During Phase 2, it will determine which element that will be included in the framework and which suitable framework will be use. The element that is included in the framework will define the scope of the

architecture. The framework will act as a guideline for the organization in transition from the current view to the future view. In addition, in this phase an online repository will be established for all EA documentation artifacts to be archived.

- Phase 3: Documentation of the EA.

  In this phase is when the implementation of EA begins. The actual documentation will be done in this phase which involves analysing and documenting the organizations' current strategy, business, information, services and infrastructure.

  Besides that, it will also document the changes that affect the short term or long term scenarios that will happen when implementing EA. By identifying these changes it will also identify the possible courses of action that would be needed when encounter with different changes in the future.

  At the end of this phase it will conclude the development of an EA management plan that will describe how the architecture will transition over time.

- Phase 4: EA Use and Maintain of EA

  In the last phase EA will be used throughout the organization to achieve the goals and it also will help in support planning and assist in decision making. Evaluation and regular updates is needed to keep the EA relevant with the economy needs as well as adding value to it.

2.8 Enterprise Architecture Framework

EA frameworks provide a holistic view of the organization through hierarchical layering. By using this approach it will imply with the business alignment, data, application and technology layers. The clear view of the organizations' structure will enable them in decision making as well as planning that include all components of the organization.

2.8.1 The Purpose of Enterprise Architecture Framework

EA framework act as a guideline for organization whose implement EA. It is created to simplify the process and guide an architect through all areas of architecture (Covington. & Jahangir., 2009). EA framework will assist organization in managing their business process by describing a method for EA components and how these components fit together (Shah & Kourdi, 2007).

According to Shah and Kourdi (2007), EA frameworks play dual roles; as component specification tools and as planning and problem solving tools. As a specification tools EA frameworks document the architectural layers, models, domains and artifacts. As planning tools, the EA framework consists of baseline architecture ("as-is view"), architectural roadmaps, target architecture ("to-be view") and transition plan (Bernard, 2012). In the "as-is" view it identify the gaps that need to be fill in order to improve the organization and the relationship between different components. In the "to-be" view it will identify new strategic initiatives for will bridge the gap identified with the new components that have been specified. Architectural roadmaps will highlight the architectural milestones performed in order to reach the target architecture while the transition plans will document the activities of changes from the baseline to the target architecture. It will specify the "as-is" and "to-be" views in terms of managing the transition's feasibility. Including risk assessment, gap analysis and the transition's

supporting resources (Bernard, 2012). The relation of the dual roles is shown in Figure 2.4.

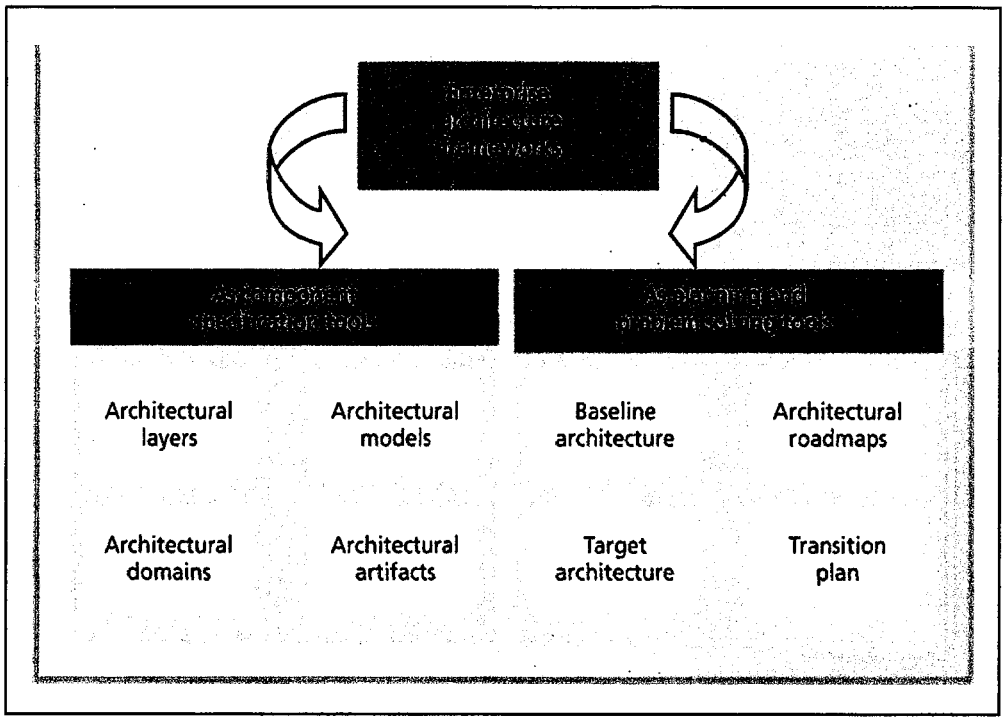


Figure 2.4 The Role of Enterprise Architecture Frameworks
(*Sources:* Shah & Kourdi, 2007)

How an EA framework assist in managing organization's process is by presenting the EA components and see how each of the components complement each other. Such as business process, data and organization units. Although most of the components are the same with other organizations, it is perceived differently according to the stakeholders (Shah & Kourdi, 2007).

EA are typically divided into four layers; business, data, application and technology layers (Shah & Kourdi, 2007).

- Business layer: Describe business process, organizations mission, vision and goals.

- Data layer: Describe the relevant organizations' business information.
- Application layer: Describe the tools used, software applications that support the business layer.
- Technology layer: Comprises the hardware platforms and communication infrastructure that supports the applications.

Types of Enterprise Architecture Frameworks

There are various types of EA framework provided in literature. This is because the usage each framework created depends on the suitability with the organizations' purposes. The EA frameworks that will be review in this research is the Zachman Framework, The Open Group Architectural Framework (TOGAF) and EA Cube Framework.

I. Zachman Framework

Zachman Framework was published by John Zachman in 1987. It is considered as one of the pioneers in this domain (Urbaczewski & Mrdalj, 2006). According to John Zachman the need of logical construct is because the increasing of information system implementation complexity and increase in scope of designs.

Zachman Framework based on the principle of classical architecture that establish a daily basis vocabulary and a set of perspectives for describing enterprise systems. It have two dimension where in the first dimension consist of six perspectives; Planner, Owner, Designer, Builder, Subcontractor, User. In second dimension it deals with six basic questions such as what, how, where, who, when, and why.

The focuses of the Zachman Framework is ensuring all views are well established and a complete system regardless of their orders.

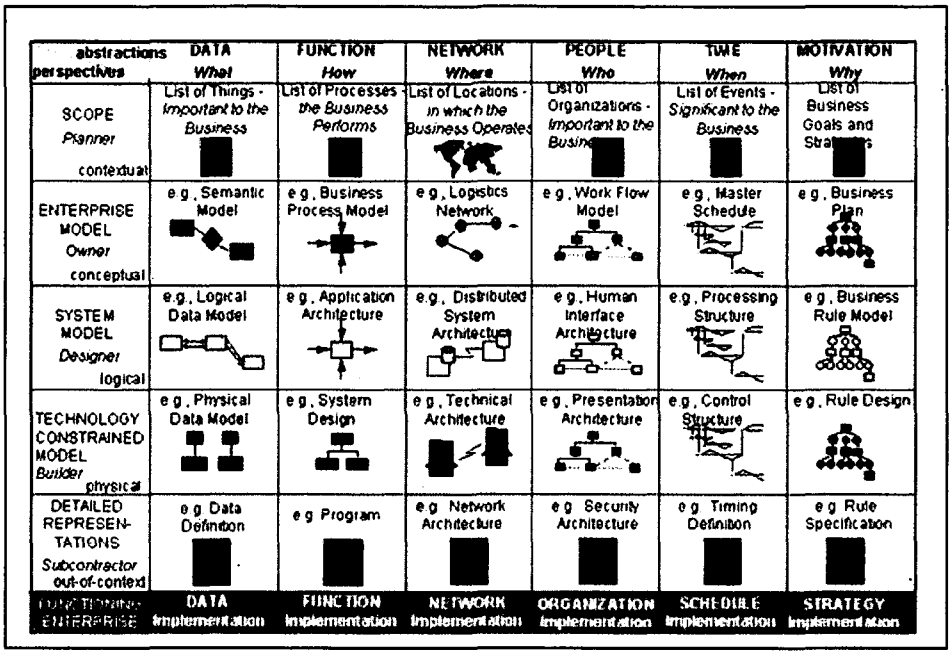


Figure 2.5 Zachman framework

(*Sources*: Zachman, 2001)

II. The Open Group Architecture Framework (TOGAF)

TOGAF was established in 1995 based on the Department of Defense's Technical Architecture Framework for Information Management. TOGAF explains the rules in developing a good principle, rather than providing a set of architecture principle like Zachman Framework does. The key element in TOGAF specifies a process for developing EA and that is the Architecture Development Method (ADM).

TOGAF focuses on critical business applications that use open systems building blocks. There are three levels of the principles that support the organization's decision making; provide guidance of IT resources, support architecture principles for development and implementation.

III. EA Cube Framework

EA Cube Framework can be split into two different views. Whereas the first view carries the "as-is" view and the second view is the "to-be" view. The "as-is" view covers the state of the current EA while the "to-be" view will cover the future views of the organization.

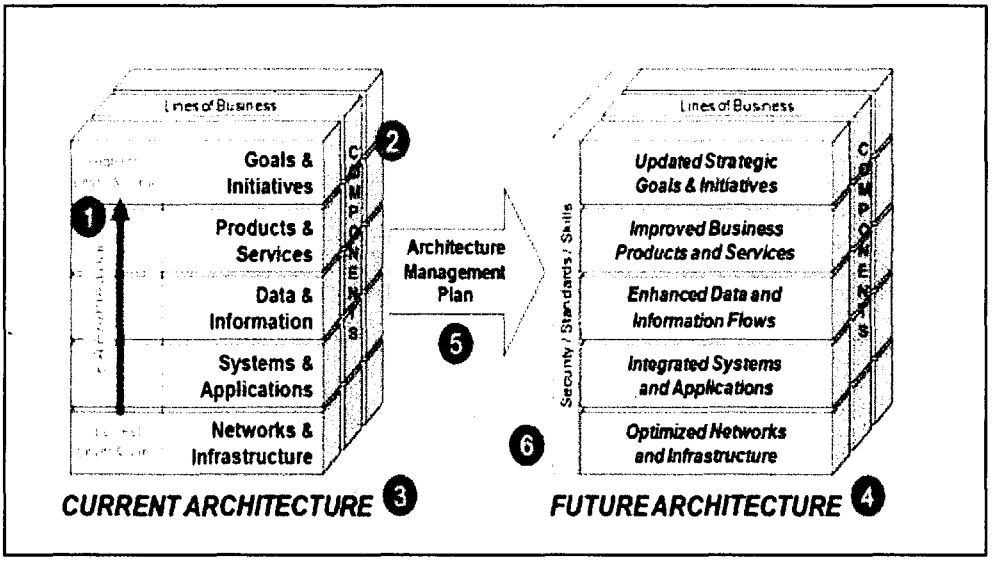


Figure 2.6 EA Cube Framework

(*Sources* : Bernard, 2012)

Based on Figure 2.6, the framework is in cube shape where the first cube represent the current view and the second cube represent the future view The vertical component is a goal, resource, standard or process that serves one Line of Business (LOB), the horizontal components is defined as a goal, resource, standard or process that serves several LOB; a division the organization produce a product or service that the customer can benefit from. When implementing the EA Cube Framework there are six steps that need to be a part of the framework in order for it to complete (Bernard, 2005).

1. EA documentation framework.
2. An Implementation methodology.
3. Current view of EA.
4. Future view of EA.
5. The EA management plan transformation from the current view to the future view.
6. The elements that support the issue that can be reused throughout the architecture that is known as the concept "thread". Examples are security, standards.

Based on the EA framework listed above, it can be concluded that EA framework identifies the scope of the architecture to be established within the organization (Bernard, 2012). Established by creating relationship between the EA components. The EA components is not set to a certain components, it vary based on the organizations' purposes and goals (Niemi, 2008). How EA framework assist the organization is by providing model in a way that it able to collects and organizes the architecture's information.

By giving variety in choosing the EA components for the framework, it allows the EA not to function effectively. In order to gain information on whether the framework works effectively or not, measuring of EA can be done. With EA being implemented by stages, measures could be done any time according to EA stakeholder. Measuring of EA is crucial as it will create awareness for the organizations (Tamm, Seddon, Shanks, & Reynolds, 2011).

2.9 Measuring Enterprise Architecture

EA is an investment where the ROI is ought to be seen. Therefore there must be a way to prove their worth. EA is executed with various goals. Which include; creating harmony with business, data, application and technology layers, the organization transition, planning expansion of information and

communication systems and create a common organizational language (Jahani., Javadein., & Jafari., 2010)

There are four aspects when measuring which are; communication value, strategic value, tactical value and governance value.

- **The Need To Measure Enterprise Architecture**

EA is being measured in order to determine the success and failure of in EA. There are few factors that give impact in EA's success (Jahani. et al., 2010) shown in

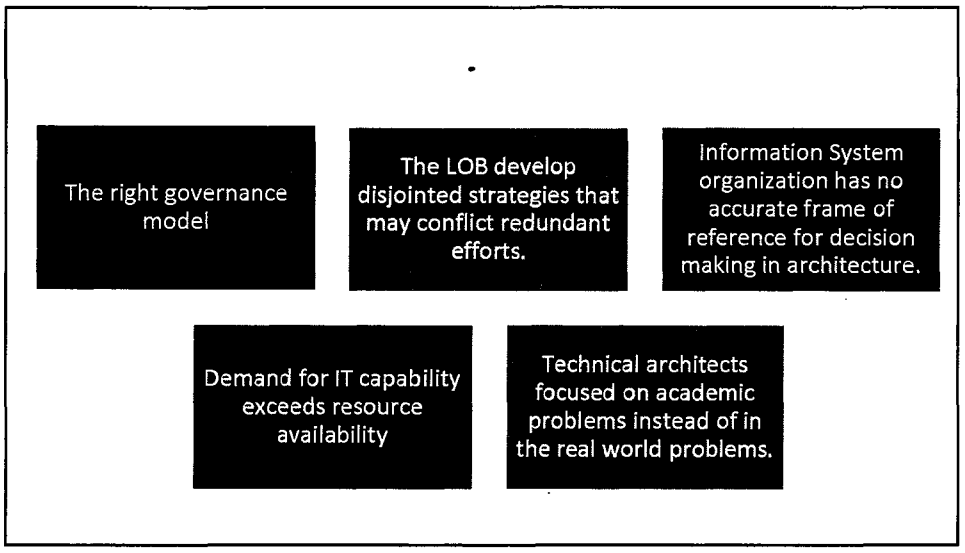


Figure 2.7 Impacted factors on EA success

(*Sources* : Jahani et al., 2010)

There are stages in implementing EA within organization whereby the implementation need to be done by stages respectively. There is no specific time or the 'right time' to measures EA. Each measures carry different purposes, thus each type of measures carried out in different time. The types of measures in EA within organizations for examples are measures the readiness of EA, the maturity level of EA, the knowledge management of EA and so forth.

2.9.1 Tools Used To Measure Enterprise Architecture

Tool that is used to measure EA can be in form of modeling, framework, metrics. Depending on the suitability in what aspects EA is being measured. However too many models are produced in measuring the organizations' EA, hence often times the result is not sufficient. According to Rico (2006) there are few aspects that need to be overview when creating their own models, shown in Figure 2.8.

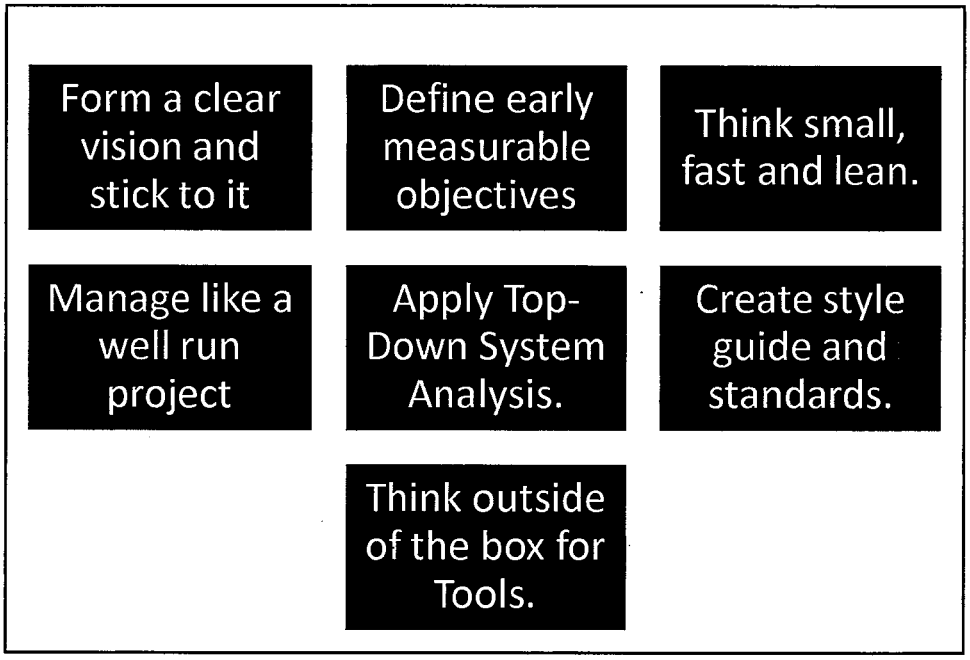


Figure 2.8 Principles in Creating Own Model (Rico, 2006)

However, besides creating own models for measuring there are already established tools that can be used in measuring EA as well.

a) Score Card

The Balanced Score Card (BSC) originated by Dr. Robert Kaplan and David Norton is a strategic planning and management system. It is widely used in business and industry, government, and non-profit organizations worldwide. The purpose of BSC is to align business

activities to the vision and strategy of the organization as well as improve internal and external communication and monitor organization performance against strategic goals.

BSC provide clear prescription as to what companies should measure in order to be balance in their business activities

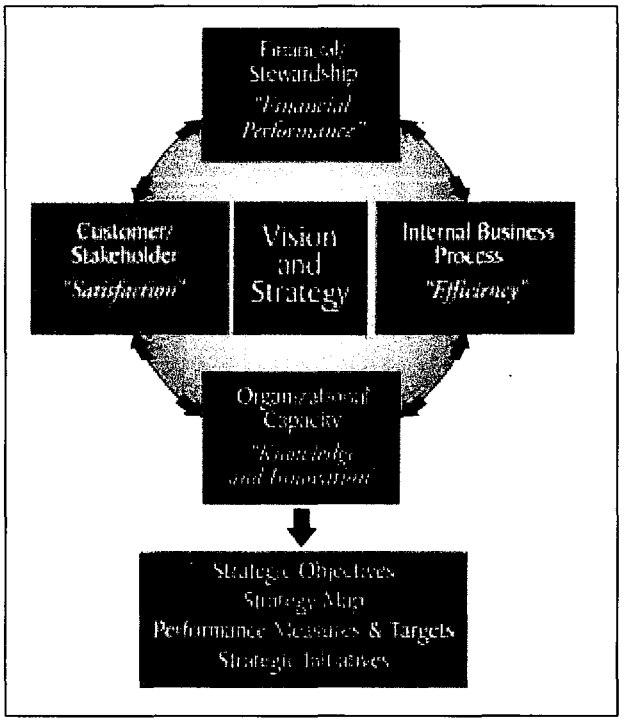


Figure 2.9 Adapted from Robert S. Kaplan and David P. Norton, "Using the Balanced Scorecard as a Strategic Management System," Harvard Business Review

b) Balanced Score Card for Enterprise Architecture

The BSC methodology links strategic goals and translates them into action. A set of measures of BSC can assist top managers a fast but comprehensive view of the business. It is balanced between financial and operational aspect. When measuring EA using BSC will conceptualize EA value that will allow for a multidimensional view of

value not only from financial perspective (Kaplan & Norton, 1995). This call for a framework to be develops.

When developing a framework, the design has to integrate all the aspects of BSC and EA. To match the four perspectives of the genuine BSC with the EA terminology, three of four perspectives were renames as follows (Kaplan & Norton, 1995) :

1) Customer perspective: Services
2) Internal Business Perspective: Processes
3) Innovation and Learning Perspective: Assets
4) Financial Perspective: Finance

However in delivering this research, based on the interview conducted with the BRM, the EA measurement in Ministry of Finance (MOF) requires specific elements to be measured. Therefore, by constructing an evaluation model will assist MOF in carrying the measurement in their next EA practice.

2.10 Summary

To summarize this chapter is all the literature related with this research is provided in this chapter. The flow of this chapter will assist reader in understanding the content of this research study.

CHAPTER 3

METHODOLOGY

The research methodology adopted to achieve the objectives of the research is described in this chapter. In order to complete this research, it is necessary to have method in carrying the activities to deliver the outcomes. Therefore, this chapter will discuss on the method used and the phases carried out in this research.

3.1 Research Methodology

Research can be conducted using various methods. Qualitative and quantitative methods are often used in conducting research. By definition, qualitative research is a scientific research where it consist of deeper investigation that is done by seeking answers to questions, produces findings that are applicable beyond the immediate boundaries of the study (Mack, Woodsong, MacQueen, Guest, & Namey, 2005).

Qualitative method is beneficial in exploratory research as it define the problem or develops an approach to the problem (Mack et al., 2005). As for quantitative research, it is an act of seeking information of the identified problem, based on testing a theory, measured with numbers, and analyzed using statistical techniques.

A comparison between qualitative and quantitative research is made in order to identify the suitable method in carrying out this research. The comparison is made based on their objectives, types of questions constructed, types of data instrument used in collecting data, forms of data they produce and their flexibility in conducting the research.

Based on Table 3.1, it shows the differences between the quantitative and qualitative research. The main difference is the flexibility of each method (Mack et al., 2005). Quantitative research is more inflexible compared with qualitative research. This is because the questions constructed in quantitative research are in questionnaire and survey format. Therefore researcher must have clear understanding on the questions to be asked as the respond will be close-ended or fixed. However, it will give meaningful comparison of answers.

Qualitative research is more flexible, because the questions constructed is more spontaneous rather than being formal. The questions constructed are semi-structured and the respond will provide an open-ended answers. The respondents will have the flexibility to express their answers in details with their words and respond rather than a simple "yes" or "no". With the flexibility provided, researchers have the opportunity to gain deeper understanding on the research conducted.

The flexibility mentioned does not show the rigidness of a method is rather than it reflects the kind of understanding towards the study of the research using the method.

Table 3.1 Comparison of Qualitative and Quantitative Research

Differences	Quantitative	Qualitative
General	• To confirm the assumption made about phenomena. • The instruments used are more rigid in responding to questions. • Questions constructed are	• To explore phenomena. • Instruments used are more flexible in categorizing the questions responses. • The questions

	highly structured such as questionnaires, surveys and structured observation.	are semi-structured such as in-depth interviews, focus groups and participant observations.
Analytical objectives	• To count the variation. • To predict the cause of the relationship.	• To describe the variation. • To describe and explain the relationship.
Question format	Close-ended.	Open-ended.
Data format	Assigning in numeric form for responses.	In textual form for responses.
Flexibility in study	• Study design is stable from beginning to end. • Participants' responses do not determine which questions researchers ask next. • Study design is based on statistical assumptions and conditions.	• Flexibility in the aspect of study. • The researchers' questions affected by the participants' responses. • Data collection and research questions are adjusted according to what is learned.

Source: Mack et al. (2005)

In this research, qualitative research methodology is used. The advantage of qualitative research is suitable with this research. The questions in this

research are semi-constructed method; in-depth interview, focus groups and participants observations which give ability for respondent to answer in detail and this allow researchers to have in-depth regarding this research. The flexibility for the respondent to answer the questions is crucial in order to gather and analyze data that must be achieved in the second objective. Qualitative method also allow researchers to engage with the respondent where they have the opportunity to ask what, why, who, when and how questions. The flexibility in qualitative method will encourage respondents to elaborate their answers in details.

3.2 Methodology Diagram

In Figure 3.1 it illustrates the four phases that are conducted to complete this research. The diagram shows the flow of the phases as well as the activities, deliverables and the objectives achieved. Table 3.2 describes the notations used in Figure 3.1

Table 3.2 Diagram Description

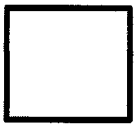
Notation	Explanation
	Rounded-rectangle represents the phase.
	Square shape represents the activities that are carried out during the phase.
	The leaf-shaped explains the deliverables of activities carried out in each phase.
	This dashed-line rectangle will show the objective achieved after the deliverables of the respective phases.

Table 3.2 (Continued)

	The arrow will show the flow of each phase from phase 1 until phase 4.

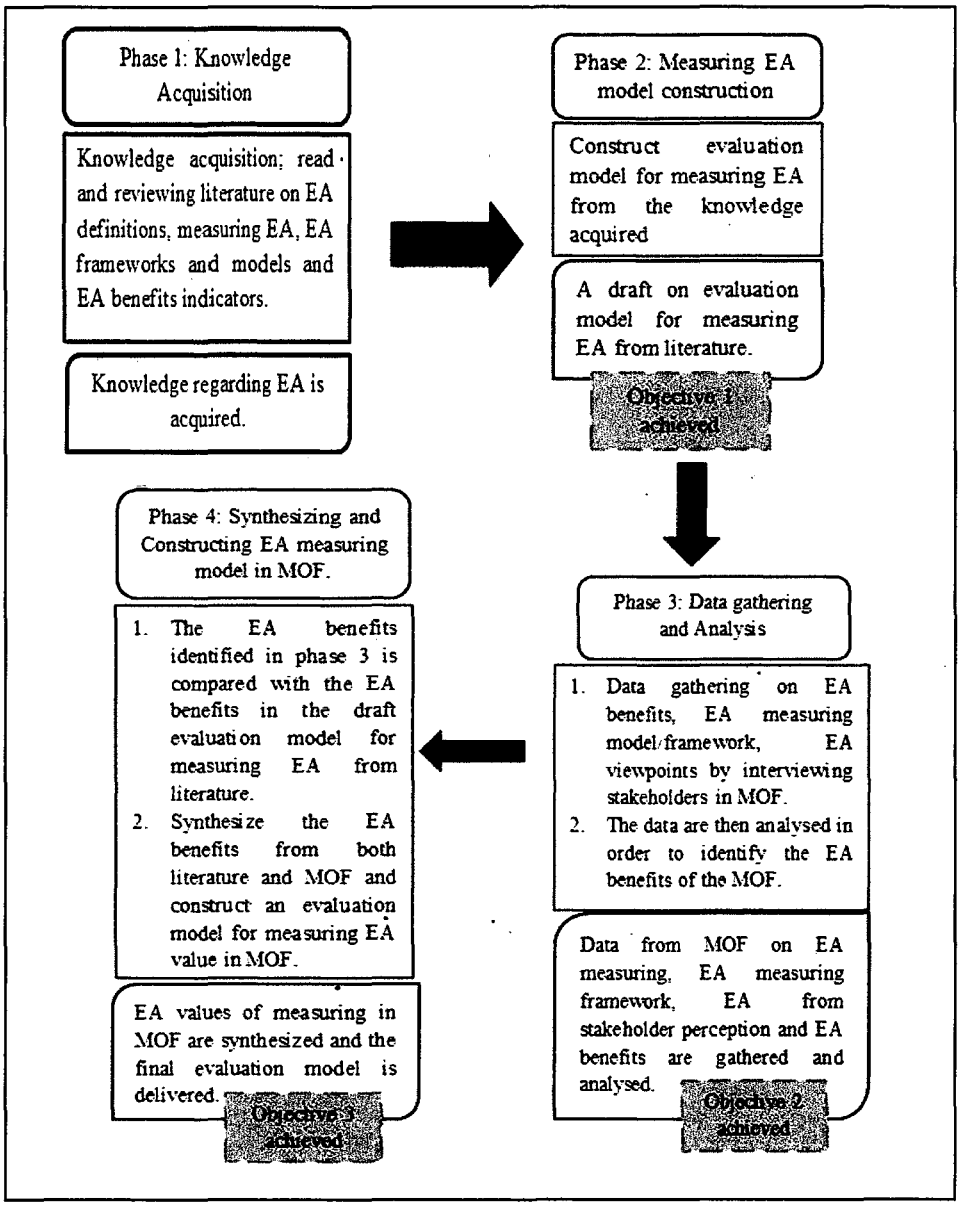


Figure 3.1 Methodology phases diagram

3.2.1 Knowledge Acquisition Phase

Defining important terms and concepts that are used in a research upfront, give the researcher and stakeholders a shared understanding. Understanding the definition of 'measure' is needed in order to carry out this project. A clear understanding on 'measure' will channel the mind into thinking what need to be done in order to carry out measurement. The definition is understood from the general perspective which then leads to defining it for organization. The perspective from organization is needed as the focus in this project is measuring EA that takes place in organization. Hence, by measuring will assist organization in finding the value of initiatives that will bridge the gap of the organization (Jahani. et al., 2010) For this research, the new initiative is EA.

In knowledge acquisition phase, knowledge and information regarding EA is reviewed and analysed from general perspectives. All perspective on EA is taken into account in order to gain deeper understanding about EA; basic understanding on EA, such as its definitions. EA represent complex components and its relation to achieve enterprise goals (Gorazo, 2014). One of the pitfalls of EA is that literatures offer many definitions of the term. Some of which are complementary and some are in opposition. Therefore, it is necessary to identify which definition is suitable to be used in this research.

When basic understanding on EA was gained, next is to have deeper understanding on EA's purposes, stakeholder, and implementation methodology. In order to understand its purposes, stakeholder, implementation methodology and EA framework, a lot of critical thinking needs to be invested in order to understand its concept. Questions of what, why, who, when and how also known as 4W1H are constantly needed to be asked with oneself upon reviewing and analysing the articles.

Lastly, in understanding EA benefits where this project focused on four benefit indicators, EA as an investment and the need for it to be measured. A

few of case study need to be analyse on EA being an investment for the organization as well as their need to be measured. Case studies need to be reviewed as it can assist in data gathering and analysing which is done in phase 3.

The knowledge acquired in this phase will assist in constructing a draft of an evaluation model for this project in phase 2.

3.2.2 Measuring Enterprise Architecture Construction Phase

Knowledge acquired in the previous phase will assist in constructing an evaluation model for measuring EA from literature. The construction of the evaluation model for measuring EA is based on four benefit indicators; communication value, tactical value, strategic value and governance value. The elements are identified according to the suitability and understanding of each of the value. Articles are reviewed and analysed on the measuring elements. This evaluation model will identify what need to be measured for each of the value.

With the draft of an evaluation model for measuring EA constructed, it will help researcher to have clear understanding on measuring EA. Therefore will assist them measuring EA within organization.

3.2.3 Data Gathering and Analysing Phase

During Knowledge Acquisition phase, roles of EA stakeholders are discovered. This discovery assists in identifying the requirements of the appropriate stakeholder to be interviewed. The appropriate interview must be involved during the implementation of the EA in the organization. If possible to get stakeholder that involved in the practice from the beginning. The stakeholder should also be involved in the previous evaluation exercise.

In order to gather data, it is required to prepare a set of interview questions (refer appendix A) and make appointment with the identified person. Case studies reviewed in phase 1 will help in constructing a set of interview questions. The entire set of question is to analyse the organization's understanding on EA and their measurement practice in order to have no confusion in data gathering.

The next step is to arrange interview session with the stakeholders from the identified organization. Stakeholders that are planned to be interviewed are from The Malaysian Administrative Modernisation and Management and Management Planning Unit (MAMPU) and Enterprise Architecture Body of Knowledge (EABOK) and Ministry of Finance Malaysia (MOF). These organizations are selected because there are few of the organizations that practice EA.

This research only managed to email MAMPU, EABOK and MOF regarding this research, however no respond to the email sent. Lastly, a decision has to be made by going to the MOF office and the researcher is managed to conduct the interview on the same day. Therefore, MOF is the identified organization for this research because from the class visit conducted on 19th April 2015, BRM mentioned on the MOF EA practice evaluation that is still new in MOF.

Data gathered is then analysed. The analysis of the data is made by comparing with the deliverables in the second phase of this research. The value of EA measurement in the MOF is then compared with the value in the evaluation model for measuring EA from literature that have been constructed during the second phase.

The finding of gathering and analysing data on EA measurement in MOF is completed and the second objective of this research is achieved.

3.3 Synthesizing and Constructing Enterprise Architecture Measuring Model Phase

The definition of synthesizing from Merriam-Webster (2015) dictionary is the combination of something in order to generate something new out of it. It is also defined as combination of ideas, styles, or systems into a single idea or system. In the last objective the draft evaluation model from secondary source is synthesized with findings from MOF and the four EA benefit indicators; communication value, strategic value, tactical value and governance value. The result is an evaluation model that is holistic to MOF and which is hoped to assist them in their next evaluation for value measurement in communication, strategy, tactical and governance.

The activity that is carried out in this phase is the elements in the draft evaluation model for measuring EA from literature that is constructed in the second phase is compared with the elements identified from MOF for measuring EA. The elements derived from the data gathering and analyzing which is done in the third phase with MOF. The elements are grouped into four benefit indicators.

The synthesizing of both model from literature and the elements from MOF will give a brief understanding on the needs and the values that will be gained for the organizations when their next EA is measured. They will not only gain benefits out of the synthesizing evaluation model, they will be able to create more value in their future EA practice within the organization.

3.4 Summary

This chapter provided brief explanation on the activity carried out along the completion of this research. All the phases are followed accordingly in order to achieve all the objectives stated in Chapter 1. Therefore, the results and finding from the activities mentioned in this chapter is elaborated in details and in-depth in Chapter 4.

CHAPTER 4

ANALYSIS AND FINDINGS

This chapter presents the analysis and finding of the case study. The analysis is divided into three sections where the first section would examine the first objective followed by the second objective where the final section synthesizes the findings and summarized the overall result.

4.1 Acquisition Phase

It is crucial to have solid background understanding in conducting any research. This is to ensure every search of information, reading and reviewing on articles and interview conducted bring value to this research. During this phase, as much information accessible regarding this research is acquired.

The definition of 'Measure' is understood from the general and organization's perspective. Simply in general 'measure' is any maneuver made as part of progress toward a goal ("Measure definition, 2015"). This can be done in ensuring the effort taken to achieve goal is worthwhile.

For organization by measuring they can evaluate their business process and aware with their progress in achieving their organization mission, vision as well as goal. Measuring may act as a management tool as it can create awareness for the organization in taking precaution step for future action that is to not commit to the same mistake twice. This shows that it is needed for organization to measure their business process to strive successfully.

However, the dynamic growth of the economy forces organization to grow as well in order to compete with other organizations. With current economy, technology plays an important role in business processes. Therefore aligning

the business process with technology is crucial, hence EA is perceived as the initiative in developing the organization.

EA has the ability in aligning the business process with IT. There are four main domain of EA (Gorazo, 201);

- The business architecture: Defines the business process of the organization.
- Data architecture: Has the accessibility in the information require for the process.
- Application architecture: Applies the information acquired to the technology architecture.
- Technology architecture: Identify the tools; hardware, storage systems and networks, to carry out the three domains.

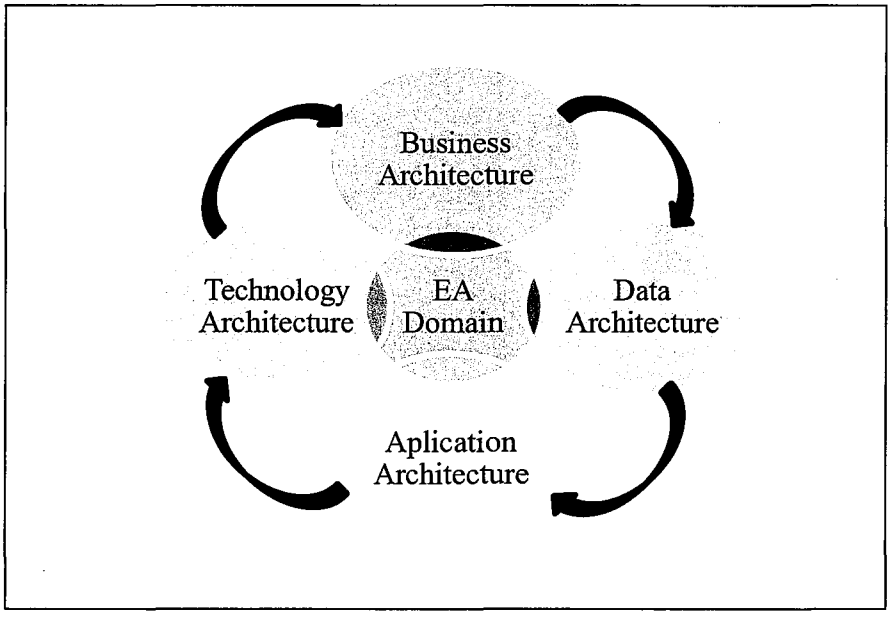


Figure 4.1 EA domains (Gorazo, 2014)

Figure 4.1 show that EA can be understood from its domain whereby the flow of the relation is noted with arrows which begin from business architecture and ends with technology architecture. Figure 4.1 shows that after technology

architecture the arrow notation go to business architecture again, this to ensure the data that applied in the technology align with the business processes of the organization. Each of this architecture has its own function and it relates with and supports each other. In order to carry out the functionality of each domain, there are roles responsible in EA.

Roles in EA are responsible in ensuring EA is practiced according to plan. Roles of EA are divided into three stages;

1. The one who initiate the need of EA for the organization.
2. The one who implement EA within organization.
3. The one impacted with EA.

Usually, EA is initiated by the top level management, however, in order to avoid the situation where decisions is made without considering the one delivering the task such as the middle and low level management, communication is needed among each management. The one who implement EA are responsible in conveying message among the management in order for them to have the basic understanding of EA concept. Lastly the one who are impacted by EA. EA is constantly changing as it moves with the rapid change of technology in order for the business process to be aligned with current technology. Therefore, each of this change is impacted to the employees of the organization.

EA is famous with the Zachman Framework as it is the pioneer of EA. The framework plays an important role in assisting organization to have a holistic view of their business processes. After the Zachman Framework, there are several frameworks that come after such as TOGAF, Spewak, EA Cube and more. However there are frameworks that are constructed based on the organizations suitability and some of the idea come from existing frameworks are adapted into their in-house framework. This gives benefits for

organization that implemented EA as it gives flexibility for organization to suit their business process.

Many benefits of EA are acknowledged in conducting this research. Benefits such as the holistic view it provided for the organization, avoiding the "ivory tower" syndrome of an organization, the business-IT alignment and many more discussed in chapter two. By reviewing EA benefits shows the value EA brings to an organization. However, not many articles review on EA benefits as each organization carry different benefits of EA. This is because due to different business processes and situations. If EA is not practiced efficiently or the organization does not get support from their stakeholder, the benefits of EA could not be realized. To make it efficient in realizing the EA benefits, there are four benefit indicators identified by Zhu (2013) which are values of communication, strategic, tactical and governance. The benefits that are provided by EA is costly, therefore it is an investment for every organization that adopts it.

With EA being an investment for organizations, it is crucial for their EA practice to be measured in order to see the worth of its values. Every element in EA has its own value but the worth it carries plays an important role as well. There are tools that can be used in measuring EA; Balanced Score Card. However, every organization can measure their EA differently according to their preferences that will reflect the worth of EA benefits to their organizations. In order to convince the stakeholders upon their investment on EA, measurement needs to be done in order to realize the EA benefits. However, measuring EA is difficult when the architecture itself is continually changing (Niemi, 2008). Therefore, by identifying the elements for measuring EA is relevant in realizing EA benefits.

Figure 4.2 shows the knowledge acquired in conducting this research and the relationship of the components. The definition of measurement need to be acknowledged before doing this research. The definition is from two

perspectives; from general and for organization. It is then understood that measurement act as a management tool. In evolving organization, EA is known as the initiative for organizations to have the ability to compete with other organizations. Reviewing of EA gives in-depth understanding flow of EA; from EA domain, roles of EA, EA framework, EA benefits where benefit indicators are categorized into values of communication, strategic, tactical and governance. Then EA is understood as an investment which lastly leads to the need for EA to be measured.

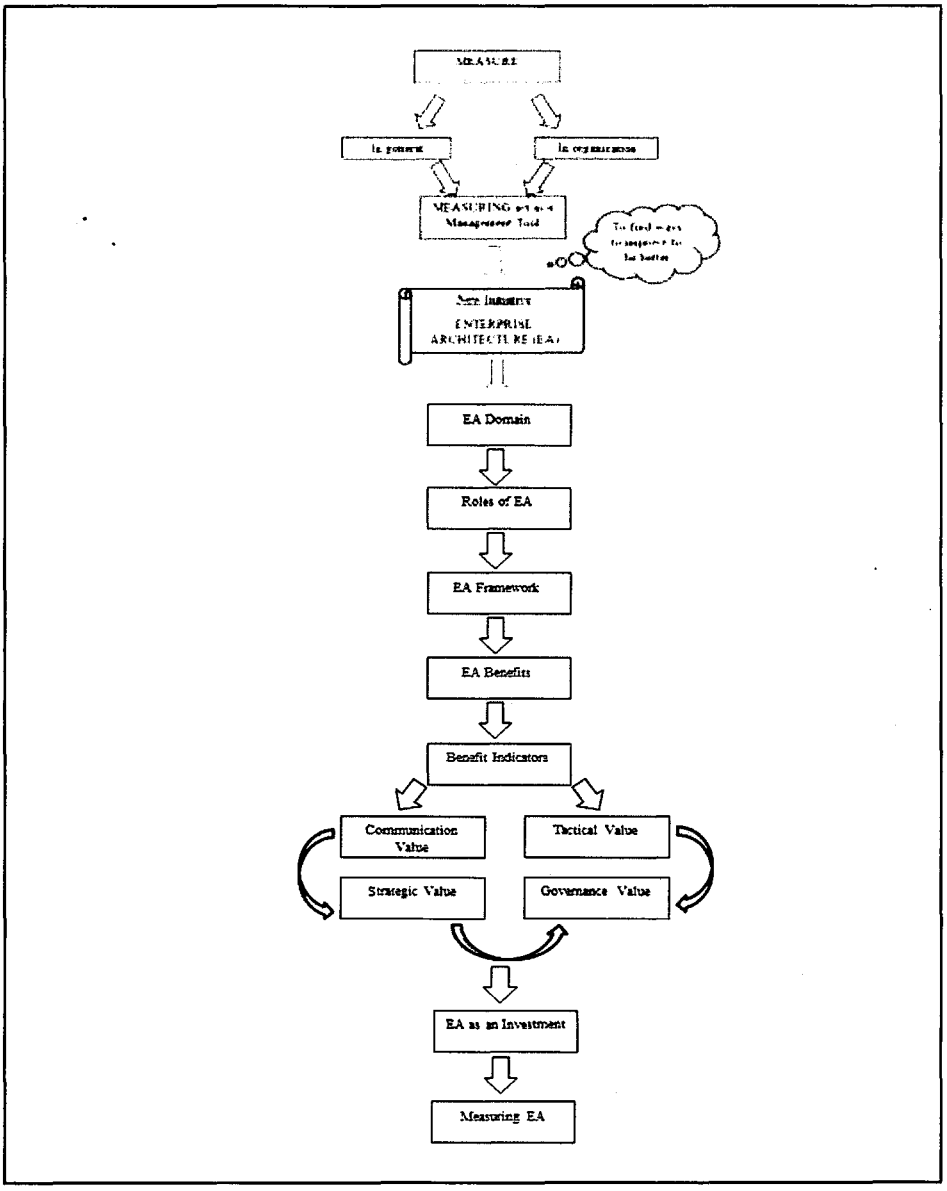


Figure 4.2 Graphical Representation of Knowledge Acquisition

This phase provide the necessity in drafting the evaluation model for measuring EA which is the objective one for this research. The knowledge acquired makes it convenient during the construction of the draft on evaluation model.

4.2 Draft on Evaluation Model for Measuring Enterprise Architecture

By identifying the benefits of EA it help in extracting the elements for measuring. In Pearl Zhu (2013) *Four Aspects in Measuring Enterprise Architecture Effectively* there are four benefit indicators mentioned which brings value of communication, strategic, tactical and governance. (refer Figure 4.3).

- Communication shows the value of EA as the medium for organization in conveying message or information regarding their business processes (Zhu, 2013). Communication is very important because any miscommunication that happens will affect the performance of the organization. By communicating with each department helps in spreading the concept of EA, as in Malaysia is common for organization to have poor understanding regarding EA (Razak, Dahalin, Ibrahim, Yusop, & Kasiran, 2011). Communication ensures the purpose of EA is understood by every management of the organization in order for the benefits to be realized.

- In order to realize the EA benefits, it has to be strategically delivered. This to ensure the transition from the current to the future business process is organized and effective. By being strategic will give the ability to have holistic view of the organization (Zhu, 2013). Holistic view gives opportunity for the organization to strategically plan their management by linking each of them in order to successfully execute their business processes.

- Tactical value gives the purpose of adopting EA within the organization. It explains the reason of adopting EA and the value obtained out of it. This value will assist in realizing the effectiveness and the efficiency of EA (Zhu, 2013). It assisted by measuring the improvement of the organization's performance in ensuring it align with the business process and achieving its mission, vision and goal.

- Holistic view provided adds governance value to the organization adopting EA. Governance right is other key area of EA value. It able to determine risks and to mitigate it. However not every risk is identified until detail implementation of the architecture/plans are developed (Zhu, 2013). It is important to have the ability in identifying risk of any implementation within an organization as this will reduce the unnecessary effort made that eventually will cost the organizations. Precaution step is ought to be taken in order to avoid the loss.

From the values of the benefit indicators mentioned, it is necessary to identify the elements that need to be measure for the values. Each of the elements is generated from reviewing literatures. It is mapped onto the four values. The structure of the draft on the evaluation model adapted from article by Giaglis, Mylonopoulos and Doukidis (1999) of *The I.S.S.U.E Methodology for Quantifying Benefits from Information Systems.*

In Figure 4.3 the values mapped onto the model are the four benefit indicators; communication value, tactical value, governance value and strategic value.

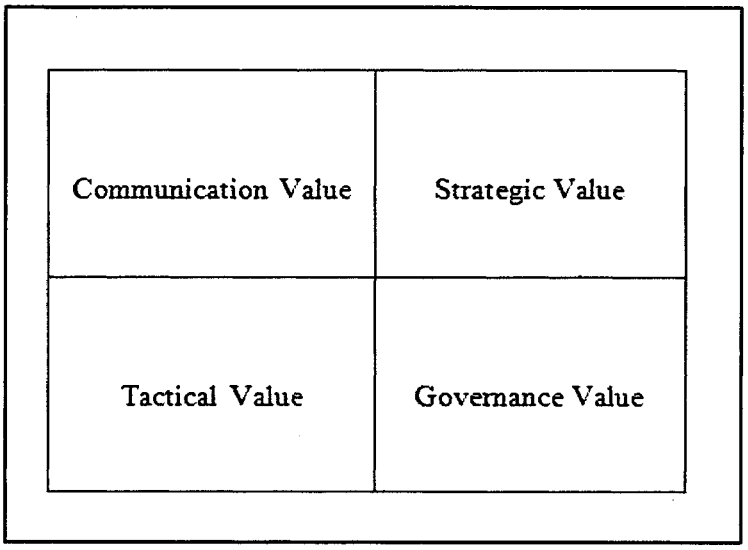


Figure 4.3 Structure of draft on EA evaluation model
(Adapted: Giaglis, Mylonopoulos, and Doukidis (1999))

The information availability gives the value of communication by the standardized and shared reference information in the organization. By having the same resources in gaining information give the organization a better access to information, therefore improved in understanding of resources and processes (Bernard, 2012). With common data, the data will be more accurate and timely. Miscommunication within the organization can be avoided when the same resources of information is gained.

There are few elements from Bonnet (2009) that is when measured bring the value of communication. By measuring the understanding of IT by business will ensure the communication in the organization is communicated well. When IT is understood by business, the alignment of business with IT can be managed as well. It is also relevant for the business to be understood by IT in order to have synchronization in communicating with each other. Ways in communicating with both business and IT can be done by having effective management style.

An effective management style will assist in ensuring communication is properly done in the organization. Communication is important, because EA constantly changes, therefore the readiness for changes is needed for the organization. By measuring the effectiveness of the management style will improve the management in delivering information regarding EA changes and business of the organization as well as responsiveness to changes.

By measuring the ability to be responsive to changes will ensure the agility of the organization. Agility is the ability and willingness of management to initiate changes in order to implement new business ideas or introduce new technology (Bonnet, 2009). Being responsive to changes will add communication value, because it require the organization to be aware regarding the changes in customer preferences and demands, business environment and trends, adjustability of business objectives to the changes that ought to happen from time to time.

Knowledge sharing is important in making decision. It is as decision-making support where the knowledge shared will give deeper understanding on the changes, business process, resources and more, thus, will reduce the complexity of the changes required (Bonnet, 2009). Knowledge sharing reduces uncertainty and consequently uncertainty reduction improves decision-making, therefore reduces risk (Hubbard, 2007).

The decision-making is usually made by the stakeholder, therefore communication among stakeholder is crucial. To get the same understanding in executing the business processes while aligning with IT, same understanding on EA and business processes need to be communicated effectively.

In Figure 4.4 the communication value is filled with the elements identified from literature. The elements are;

- The information availability (Tamm et al., 2011).
- Few elements from Bonnet (2009): Understanding of IT by business, understanding of business by IT, management style, responsiveness to change, knowledge sharing.
- Stakeholder communication (Ross, Weill, & Robertson, 2006).

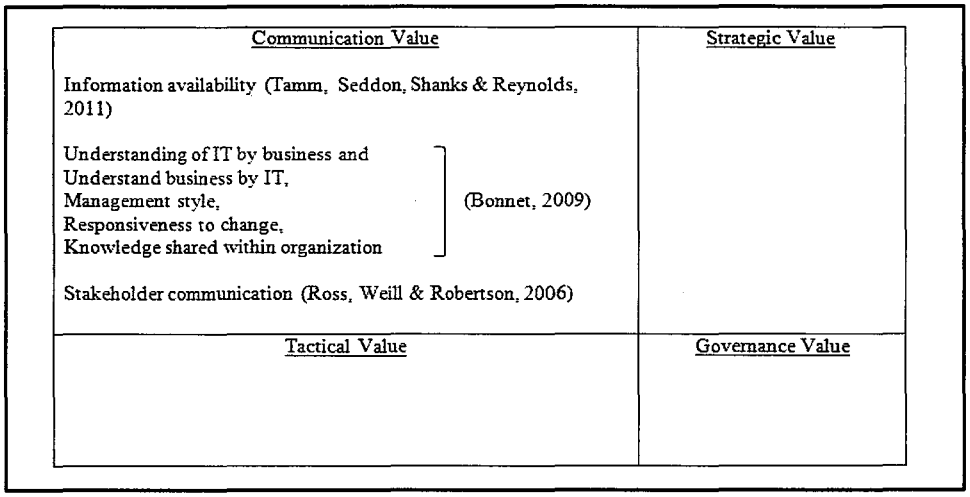


Figure 4.4 Draft of Evaluation Model on Measuring EA with communication value

One of the benefits that EA provides is the alignment of IT and business processes. In order to align the business process with current technology it needs to be strategically executed. By measuring the alignment of IT with business process will determine the strategic value of EA within the organization. The strategy value that benefitted from EA ensures the effectiveness of the measurement.

For the strategy value, resources are needed in order to properly strategize for execution. In ensuring the execution is needed in the organization, resources will assist in conveying the information. By measuring resource complementarity will improve resource integration as well as improve the performance of the business (Tamm et al., 2011). Resource complementarity ensure the compatibility of the resources with EA, it is crucial to have synchronization with resources as EA constantly change from time to time.

Few elements from Bonnet (2009) mentioned are driver and enabler for business strategy, formal business and IT strategy. Measuring these elements will ensure the strategic value of EA is worth it. The driver and the enabler for the business strategy will move the organization to execute the formal business and IT strategy successfully.

Strategy agility will measure the responsiveness of the strategy itself in adapting with changes that occur in the organization and the environment. The effectiveness of strategic agility will give organization the ability to respond rapidly to competitor initiatives and opportunities in new market (Ross et al., 2006).

In Figure 4.5, the strategic value is filled with the elements identified from literature. The elements are;

- Strategy alignment and execution (Zhu, 2013) and (Niemi, 2008)
- Resource complementary (Tamm et al., 2011)
- Few elements from Bonnet (2009): driver and enabler for business strategy, formal business strategy and formal IT strategy.
- Strategy agility (Ross et al., 2006).

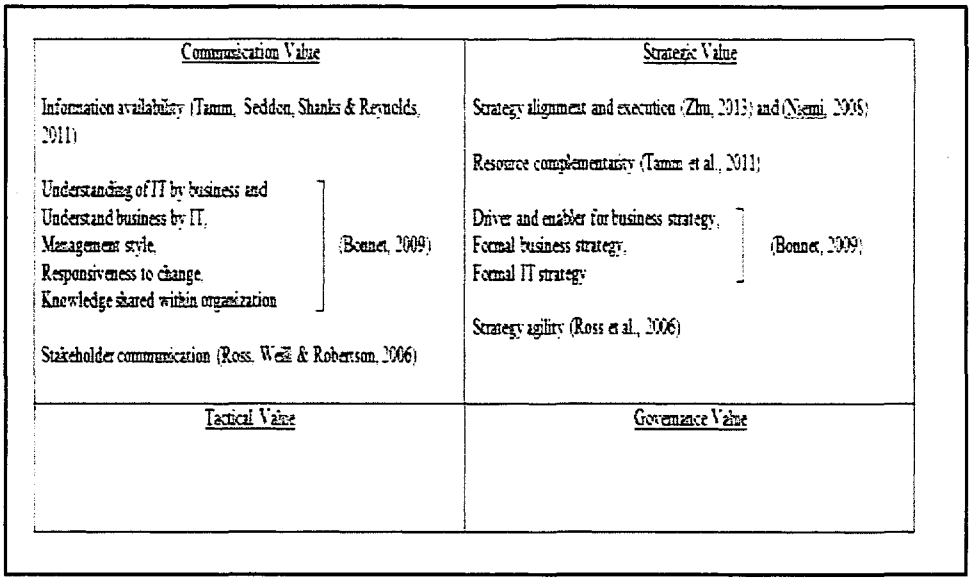


Figure 4.5 Draft of Evaluation Model on Measuring EA with strategic value

In order to realize the tactical value of EA, the efficiency of EA need to be improved with which an organization operates (Zhu, 2013). Therefore, by measuring the effectiveness and the efficiency of EA will give means of EA tactical value. Hence, the revenue generated by EA can represent the purpose of adopting EA. This gives meaning to tactical value. Revenue generated by EA need to be measured, because many of organizations involve with EA without knowing how much capital and resources they have to invest to realize EA benefits.

According to Tamm et al. (2011), by measuring organizational elements will see the value of tactical. The alignment of organizational view the integration of the organization by sharing the same understanding that is gained from improved communication within the organization (Bernard, 2005). The alignment of IT with the business process should be closely aligned to ensure the investment provide the best support for the strategic needs of the business (Tamm et al., 2011).

Educating employees regarding the EA concept is an issue that needs to be solved within organization. Hence, the time-taken in educating employees

need to be measured for tactical value. This is because by measuring the time needed in educating employees will ensure the initiative that need to be focus on in order for the education to be effective for the employees. This will provide the employees the readiness in changes that might impact them due to changes in EA.

Executing EA will be effective when it is done with clear understanding regarding its concept. Therefore, distinction between the objectives of architecting and the objectives of EA implementation should be recognized. In order to see the value of tactical, the difference between objectives of architecting with EA implementation need to measure. By measuring this elements will clarify on the stakeholders regarding the purpose of architecting as well as EA implementation. By having clear understanding on the differences it will improve the performance of the organization (Tamm et al., 2011).

Other element that can be measured for tactical value is EA delivery (Gorazo, 2014). EA delivery is the responsibility for creating and maintaining EA products. It also responsible in guiding EA in decision making (van der Raadt, 2011). EA delivery also functions for EA conformance. Therefore, by measuring the EA delivery for tactical value will visualize the purpose of EA to organization.

In Figure 4.6, the tactical value is filled with the elements identified from literature. The elements are;

- Effectiveness and efficiency of EA and revenue generated by EA (Zhu, 2013)
- Organizational alignment (Tamm et al., 2011)
- Distinction between objective of architecting and EA implementation, time taken in education employees (Bonnet, 2009)
- EA delivery (Gorazo, 2014).

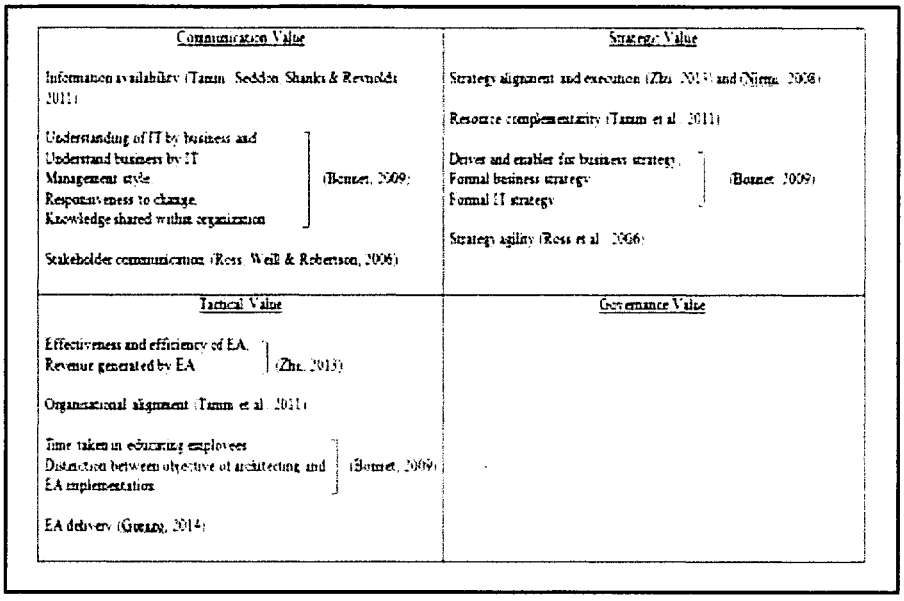


Figure 4.6 Draft of Evaluation Model on Measuring EA with tactical value

Resource portfolio optimization is leveraging the existing resources, minimizes the unnecessary duplicated resources as well as resources invests in the target performance gaps. Relation to EA, there are three primarily resource; human-resources, IT and business processes. By measuring the resource portfolio optimization will identify which resources that can be replace with more efficient resources to assist in achieving the organization's goals (Tamm et al., 2011). Resource portfolio optimization needs to be measure for governance value.

Prioritization in decision making is crucial, because the limitation in time always occur. Prioritization and allocation of IT resources must be governed by business and IT. This to ensure the alignment of business and IT. Therefore having the ability to prioritize in decision making is important as it will affect the organization performance. Holistic view that EA provides in governance value assist decision makers in making decision.

The internal performance of the organization carries important role in ensuring the effectiveness of EA practice. They play an important role in

delivering EA successfully. The effectiveness of their performance will assist the organization achieve its goals. Hence, to ensure the internal performance is done effectively, it needs to be measured. By measuring the internal performance monitoring will show the value of governance.

By governing the organization gives an organization the ability to ensure the integration of business and IT conforming to EA. Measuring the conformance integration gives the governing value, because the conformance of EA is responsible for implementing organizational changes through solutions described in the target architectures, complying with the EA policies and provides feedback on the applicability of the EA products (van der Raadt, 2011). Conformance of EA can be measured together with the conformance integration. That is by ensuring the integration conforming to EA. Hence, will give the governance value.

The effectiveness of IT governance will ensure the investment being made by the organization has its return on investment. The cost and profit is properly spend and gained by the organization. Resources used for IT is govern appropriately conforming to EA. Therefore, by measuring the effectiveness of IT governance will show the governance value.

In Figure 4.7, the governance value is filled with the elements identified from literature. The elements are;

Resource portfolio optimization (Tamm et al., 2011)

- Elements from Bonnet (2009): Prioritization in decision making by decision makers, internal performance monitoring, the effectiveness of IT governance, cost and profit.
- EA conformance (Gorazo, 2014), (Bonnet, 2009) and (van der Raadt, 2011)

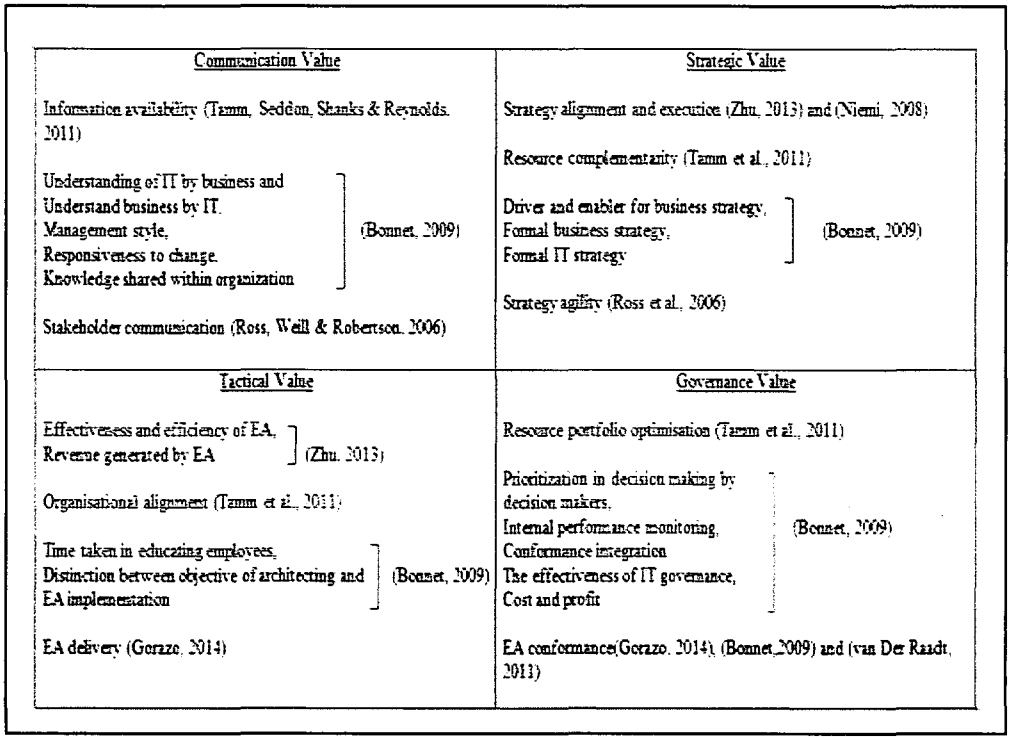


Figure 4.7 Draft of Evaluation Model on Measuring EA

Figure 4.7 shows the draft of evaluation model on measuring EA with each of the benefit indicator value filled with elements identified from literature where when the elements are measured will bring the value of communication, strategic, tactical and governance.

4.3 Data Gathering and Analysing from Ministry of Finance

The findings of data gathering and data analysis differ from each other. Therefore, by dividing it into two different subtopics will make it clearer to be explained briefly.

4.3.1 Data Gathering

The interview question is constructed by reviewing the interview questions in articles by Niemi and Pekkola (2013) *Enterprise Architecture Quality Attributes: A Case Study.* The article helps in generating ideas in

understanding how to construct a set of questions (refer Appendix A) for the interview sessions. The set of interview questions is divided into three categories, where first category consists of questions regarding the role of stakeholder. In the second category questions related to current EA implementation. The third category questions will emphasize on measuring EA. After it is constructed, it is then being checked and discussed with my supervisor. After the final amendments, email is sent to the Ministry of Finance Malaysia (MOF) requesting for an interview. The respective stakeholder identified is the Business Relation Manager (BRM) Encik Zainizam Bin Hj. Yusof. He is suitable as he is responsible in implementing and managing EA as the new initiative in MOF. During a course field trip last semester, he is the one who gave the insights and information regarding EA framework in MOF. He also mentioned about measuring EA in MOF. Therefore, with the knowledge that he has, he is able to assist in fulfilling the information required in order to complete this research.

The interview session is carried out on 11 November 2015. There were constraints with the follow up of the email regarding the interview session. The email sent did not reached the stakeholder. Hence, it creates a situation where it is needed for the researcher to go to the office of MOF and request for a follow up. The intention is notified to few of the workers at the *Unit Analisa Keperluan Bisnes Seksyen Strategi dan Perancangan Sumber Bahagian Teknologi Maklumat* department. When a meeting is finally possible with the stakeholder, the researcher briefly explained to him the objectives for the interview session. With the opportunity given, the interview is conducted. The data from the interview session is recorded with the permission from the BRM, which helped the data analysis phase.

Table 4.1 listed the raw data collected from the interview. It listed the questions asked and the answers by the stakeholder.

Table 4.1 Interview Questions and Answers

LEVEL 1 (Introduction as the Role of stakeholder in EA implementation)	
Question	Answers
1. What is your name?	Zainizam Bin Haji Yusof.
2. Which department you working on?	IT department in MOF.
3. What is your position in the organization?	Business Relation Manager (BRM).
4. Can you explain how you are exposed to EA?	By going to conferences, review literature and forums.
5. What is your role in EA implementation?	Conveying message and information to each department involve in EA.
6. How does your role affect EA implementation?	The effectiveness on the understanding of EA implementation by employees in MOF.
7. How do you define EA? Is it by process? Products?	It is an initiative, there are 38 initiatives planned in MOF.
8. What are the results? Principles? Models? Documents?	Systems that carry its own functions.
9. What are the benefits of EA?	The ability to strategically achieve MOF mission, vision and goals.
LEVEL 2(Ask about current EA implementations, challenges faced)	
Questions	Answers
1. What is your concern when you decide to implement EA?	The acceptance of the employees on EA.

Table 4.1 (continued)

2. In what level does your EA implementation are right now?	The implementation moves together with all four domains; business, data, application and technology architecture.
3. In what stages/levels/phases do you think it should be measured?	EA is always being measured to counter the changes that happen in time.
4. In what aspects that it should get measured?	In any aspects that it needed.
5. What tools do you use when measuring EA?	Treasury Transformation Program (TTP)
6. What are your challenges for current EA measured practice?	The buy-in of the stakeholder, the acceptance of the changes, the concept of EA.
LEVEL 3(Measurement Practice in EA in MOF)	
Questions	Answers
1. Why is EA measured?	In order to align with current technology as well as to improve from the current business processes.
2. Can you explain to me what are being measured? Is it the process or products?	The needs and function of the system being develop.
3. What are the elements being measured?	The effectiveness of the developing system.
4. Who are involved during the EA measurement?	There is specific department that carry out the measurement.
5. When does the measurement carried out?	Along the EA practice.
6. How long does the measurement process take? Is it according to your EA planning?	The measurement only be done when the respective department identify changes that need to be done to the current initiatives.

Table 4.1 (continued)

7. Do you use some sort of Framework or models to carry out the measurement?	Scorecard.
8. What are the results of the measurement?	Improvement on the functionality of the current initiatives being develops.
9. What are the resources utilized during implementations?	Employees, monetary term, time.
10. Are the resources spent on measuring EA implementation worth it?	Yes.
11. How did you use the result of measurement to improve EA?	The missing gap is filled with suitable improvement and the risks identified are mitigated.
12. Why do you think by measuring able to improve EA?	It removes all the unnecessary functions of the initiatives.
13. How do you value the measuring done is good?	It gives return value to MOF.
14. What are your expectations when implementing EA?	To achieve the MOF mission, vision and goals.
15. What are the impacts of measuring EA to the EA practice from the stakeholder's perspective?	A lot of challenges need to be faced as the value that EA brings is worth to MOF.

4.3.2 Data Analysing Phase

The data gathered in the previous phase needed to be analyzed in order to get the information on measuring EA. Beginning with the first category from the interview questions, a brief explanation on the role of the stakeholder is gained. The person being interviewed is Encik Zainizam Bin Haji Yusof where he holds the position of Business Relationship Manager (BRM). The role of BRM is to communicate with each level of management in MOF about the implementation of EA. He is responsible in instilling the basic understanding regarding EA. His enthusiasm in ensuring the understanding of

EA for each level in MOF is to the extent of constantly explaining EA to everyone he met even during lunch time. He is known as the "EA guy" in MOF.

Before narrowing down the questions to measuring EA it is needed to know the understanding of the stakeholder regarding EA. This to ensure the stakeholder and the research communicate with the same understanding on EA. The knowledge the research acquired regarding EA is more to theoretical value whereas the BRM understands EA both from the literature and forum as well as in EA practice in MOF. It is understood that the BRM is first exposed to EA when he is pursuing his Masters. It was a one course of introduction to EA. According to BRM, in MOF EA is defined as an initiative as there are 38 initiatives planned to be completed in order to establish a *Program Pembangunan ICT*. The 38 initiatives defined what type of systems needs to be developed in order to achieve the objective of EA in MOF. It is currently being developed where more than half of it is done. The scope of their EA is to successfully develop all the initiatives that have been planned out by the top management, where the benefits of EA are seen during the planning of the initiatives that derived a total of 38 initiatives needed to be developed. Therefore the completion of the initiatives will realize the benefits of EA. As each initiative has its own benefits and its relation that aimed towards their goals.

Moving on to the next category of the interview is regarding the current EA implementation in MOF. When BRM is asked on the EA implementation within MOF, there is comparison being made with the theoretical implementation methodology (refer to chapter 2.4) and the way EA in MOF is being implemented. In this category, the challenges in implementing EA are discussed first. When working with dateline the challenges that are normally faced are time constraint. It is a constraint during the implementation within MOF where they were given two (2) months for the implementation to be completed. Therefore a proper implementation as

opposed to EA implementation methodology in theory is not done in MOF due to time constraint. Another challenge is the buy-in of each level management about EA. Their understanding on EA is very crucial as EA is about changes and technology is dynamic. Therefore to be constantly aligned with the technology, MOF need to be aware of the changes needed from time to time. The acceptance of EA and the initiatives from all level managements are needed for the benefits to be realized.

According to the literature from Aziz, Obitz, Modi, and Sarkar (2005) of *Enterprise Architecture: A Governance Framework*, there are four stages in EA levels implementation which are Business architecture, data architecture, applications architecture and technology architecture. The BRM share the same understanding as he also explained the relation of the four stages and how it is being done simultaneously. Firstly, the business process is identified, and then the data is extracted where it require an application to run. Therefore the support from the technology architecture assists the application architecture. In MOF the four stages is identified during the planning of the implementation and as the implementation goes on, it moves together as all four stages compliments each other. Towards the end of the question session last category on measurement practice of EA in MOF is discussed.

When EA is implemented, it requires to be measured as EA is an investment of the organization, therefore by measuring it will prove their worth. In the last category the question has been narrowed down to suit the aim of this project. After identifying the stakeholder's roles as well as their understanding on EA, the questions in this category will assist in gaining insights on the elements to be measured for the four benefit indicators that has been mentioned in chapter 2. From this category, information gained is more focused on the aim of this project.

The BRM justified that EA in MOF is measured in order to improve or add more initiatives. It is mentioned earlier that EA is dynamic therefore changes constantly occur from time to time. By measuring it can identify the needs to enhance or drop the initiatives. Initiatives being dropped happened before as there is no relation of the initiatives with the objectives and cases for addition of initiatives happened as well. The one responsible in carrying out study of the alignment of the initiatives with business needs and technology is done by the Information System Planning (ISP) in MOF by studying the blueprints of EA. The elements being measured is the alignment of the initiatives with current technology, the purpose of each initiatives planned, the resources allocated for the initiatives and the acceptance of user on EA. The elements of EA measurement will be categorized and mapped onto the model that emphasize on the four benefit indicators.

The measurement in MOF is carried out by a department called Treasury Transformation Program (TTP). They monitor and measure the EA practice in MOF by using TTP Scorecard. The measurement is done all year long as when there are changes required they will take immediate action towards initiatives that is no longer efficient or add more initiatives when it is needed. The department of Treasury Transformation Program (TTP) Scorecard is used. The scorecard keep track on the systems of the initiatives whether it is completed or incomplete. The system will be monitored by its percentage. For MOF, the aspects of EA that should be measured are the efficiency of the system for the initiatives in achieving its ultimate goals. Acknowledging the tool being used by MOF to measure EA will give more information regarding how the EA measurement in MOF is carried out. However this research will not measure EA as the scope for this project is to identify the elements to be measured for the four benefit indicators. For the changes to successfully executed they need to fully utilize their resources.

There are two resources utilized in MOF which are employee from in-house and the one being out-sourced. The BRM did not enclose on where they out-

source their resources. However, the resources from in-house are measured with Time Sheet where there is a list of employees and their involvement with initiatives. Every detail regarding the employees and the initiatives they involved with is on the Time Sheet. Time Sheet is being monitored and the project work is delegated by seeing the availability of each employee.

In order to effectively measure something, one has to think with "the end in mind". The expectation of the implementation of EA within MOF from the BRM perspective is for the people in MOF to understand the purpose and need of EA so that the EA program can be developed as well as the realization of EA benefits. By realizing the EA benefits able to prove the worth of investment being made on EA implementation.

Figure 4.8 illustrated on the elements to be measured on EA based on the data extracted from the interview conducted with stakeholder in MOF. The elements generated from the interview are effectiveness of the resources in given time which may assist for stakeholder in making decision for the organization upon the changes of EA in MOF. Understanding and acceptance of stakeholders on EA also play an important role in making sure the alignment of the initiatives with current technology achieves organization's goals. Changes occur require for innovation identification and the changes and the purpose of each initiative need to be communicated well within the organization.

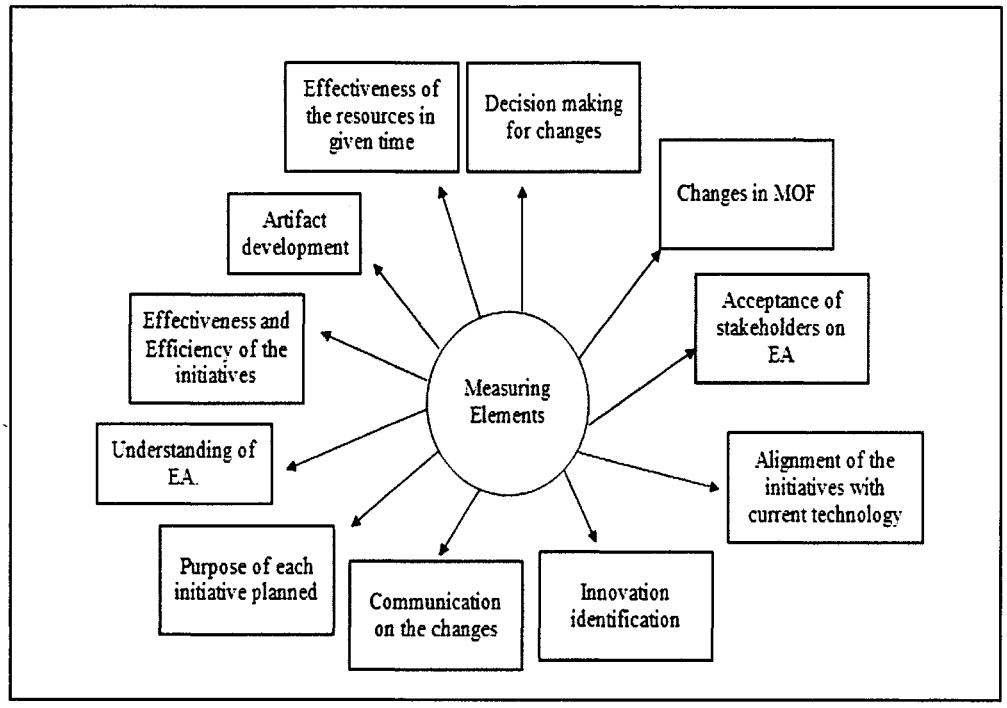


Figure 4.8 Measuring elements for MOF

4.4 Synthesized Model for Measuring Enterprise Architecture

The last objective for this research is to synthesize models for measuring EA. The model used to synthesize in this objective is the draft model for EA evaluation in (Figure 4.7) objective with the models constructed in objective two where the elements in the models generated from the interview conducted with MOF (Figure 4.8). The definition for synthesized according to Merriam-Webster (2015) is combination of something in order to make something new.

In order to synthesize the elements from literature Figure 4.7 with the elements identified from MOF, the missing elements from MOF will be filled with the elements from literature. Elements in the draft evaluation model will fill the missing evaluation elements of MOF. The synthesized model will enhance the elements for evaluating EA.

The suitability of the elements identified from MOF is based on the understanding of the BRM. Then it is mapped with the elements identified from literature reviewed.

Figure 4.12 shows the final evaluation model taken from objective one which is the draft model of evaluation model for measuring EA and synthesized with elements extracted from the interview session with MOF.

The bolded elements in Figure 4.12 are the elements from MOF. The suitability of each of this element is discussed.

4.4.1 Elements of Communication Value

The elements bold in communication value are; (Figure 4.9)

- Acceptance of stakeholder on EA.
- Understanding communication.
- Alignment of initiatives with current technology.
- Knowledge shared.

These elements are categorized into the communication value, because in order for the stakeholder to accept EA they have to gain understanding regarding EA which can be achieved effectively through communication. The alignment of initiatives with current technology can also be achieved by communication. MOF perceive initiative as systems developed according to their business processes, mission and goal. Thus, by measuring these elements will give the value of communication. These elements bring benefits to MOF.

For communication value, MOF shared the same elements to be measured that is knowledge sharing. In MOF, knowledge is important as well in conveying message among the department in MOF.

However, the suitability for MOF to measure the elements identified from literature are discussed as well;

- Information availability
  By measuring the availability of information in MOF, it able to assist MOF in gaining information regarding their business processes as well as data about its clients, suppliers and business transactions (Tamm et al., 2011).

- Understanding of IT by business and understand business by IT.
  It is important for MOF to understand both IT and business from the perspective of IT and business as well. In doing so it will help in ensuring the alignment of business with IT.

- Management style.
  The managing style in MOF will tells the effectiveness of their EA practice. A good management style will lead an organization to an efficient working style therefore bring effective results. Therefore, by measuring this elements will evaluate the effectiveness of MOF management style for communication value.

- Responsiveness to change.
  EA changes from time to time, therefore the changes need to be communicated within the organization. By measuring this elements will give the value of communication for MOF.

- Stakeholder communication.
  Communication between stakeholders is important as to avoid any miscommunication to occur. Sharing the same understanding among stakeholders will lead to better EA practice.

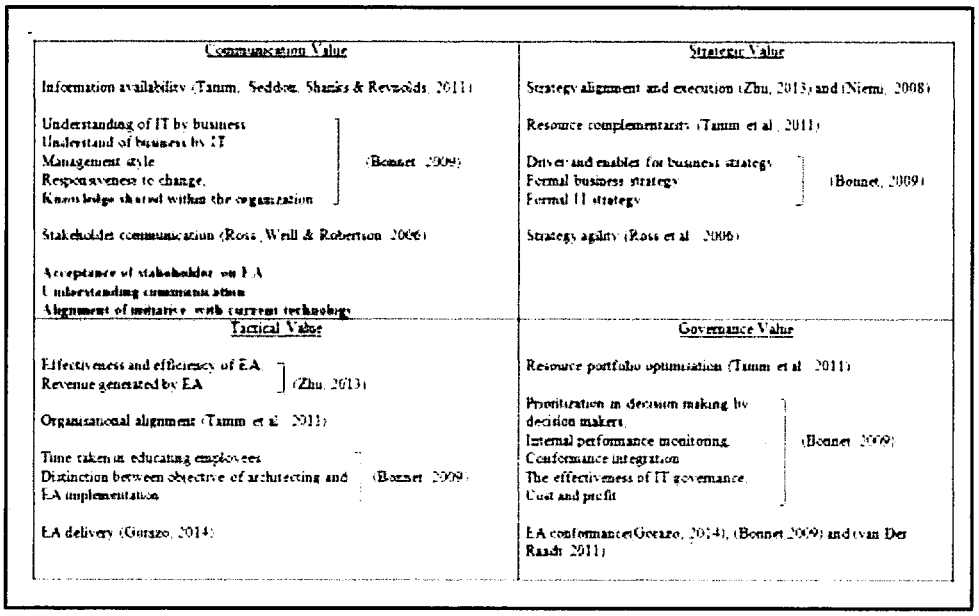


Figure 4.9 Synthesized model with filled communication value

4.4.2 Elements of Strategic Value

The elements bold in strategic value are; (Figure 4.10)

- Artifact development.
- Effectiveness of the resources.

In strategic value, MOF does not have similar elements that can be measured that are identified from literature as they are not aware of the elements from literature.

Artifact[3] development needed to be measured in order to know the efficiency of the artifact. "Artifact does not change from time to time but EA changes timely" quoted from the interview session conducted with BRM. By measuring the development of artifact may enhance the strategy in EA planning. The effectiveness of the resources can be measured as well in seeing the strategic value of EA.

[3] Artifact referred in this research is the MOF EA blueprint.

The elements from literature that are synthesized with these elements are;

- Strategy alignment and execution.
  In implementing EA within MOF, they have their business strategy. However with EA practice their strategy will align with their business processes, mission as well as goal. By measuring this element in MOF they are able to improve their strategy planning in order for better execution in the future.

- Resource complementarity.
  Measuring the resource complementarity will measure MOF resources together in supporting the pursuit for strategic goals (Tamm et al., 2011). Resources are included in the strategic management, hence by measuring the resources complementarity will value for EA strategy.

- Driver enabler for business strategy.
  What drive MOF to execute their business strategy in order to see the effectiveness of the business strategy driver. By measuring this elements not only will strategically execute the business strategy but it will motivates for MOF to execute the business strategy.

- Formal business and IT strategy.
  Every organization has their own business strategy in achieving their goals. As time changes, IT became part of the organization execution. Therefore, IT strategy is needed. When MOF implement EA, it requires them to include their IT strategy as well. Hence, by measuring the formal business and IT strategy will shows the alignment of both strategies to achieve MOF goals. By measuring this elements will give the strategic value for MOF EA practice.

- Strategy agility

  By measuring MOF strategy agility will assist them in improving their EA practice as well as ensuring their business processes are executed strategically.

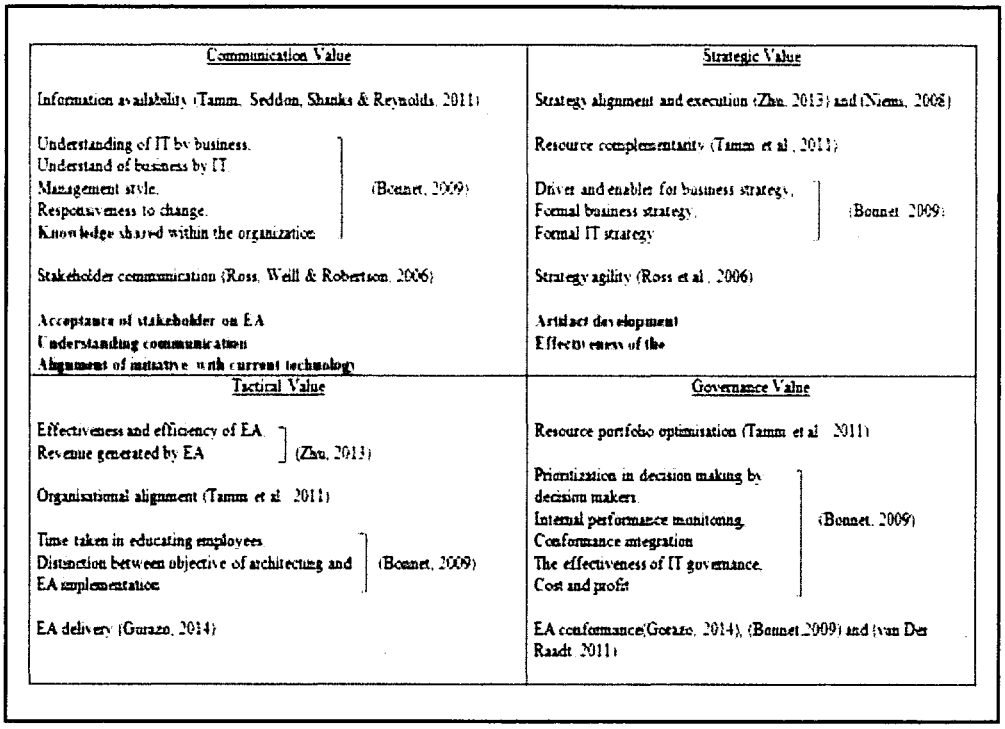


Figure 4.10 Synthesised model with filled strategic value

4.4.3 Elements of Tactical Value

The elements in tactical value are; (Figure 4.11)

- Effectiveness and efficiency of EA.
- Readiness for change.
- Purpose of initiative changes.

Tactical value is the purpose of improving the effectiveness of EA. By measuring the effectiveness and efficiency of EA as well as readiness for change will give meaning in implementing EA. Both of the elements are

similar with literatures. From the interview conducted with MOF, an element of purpose of initiative changes is identified. This element is measured to know the purpose of EA within the organization. With understanding its purposes able the employee, resources to execute the business process effectively.

The elements from literature that that are synthesized with these elements are;

- Revenue generated by EA and EA delivery.
  EA is an investment as the benefits it gives to the organization that implement it. By measuring its revenue generated, MOF able to know its ROI. By seeing the revenue generated will tell MOF the effectiveness of their EA practice and improve for their future evaluation.

  Any improvement regarding their EA practice should be maintained in order to sustain the profit perceived. By measuring EA delivery will ensure the maintenance of EA practice in MOF.

- Organizational alignment and time taken in educating employees.
  Common understanding within organization can assist in aligning with business processes. With EA implemented within MOF, it requires for employees to share the same understanding regarding EA. It could take time in educating employees on EA in order to share the same understanding on EA. By measuring this elements will assist MOF to realize the tactical value of their EA practice.

- Distinction between objectives of architecting and EA implementations.
  With shared understanding on EA it is also important for the stakeholders to be able to differentiate between objectives of architecting with EA implementations. EA objectives and EA

implementation have its own differences and function. Where EA objectives show the purpose of architecting an enterprise and EA implementation tells on the implementation process of EA within organization.

Therefore, by measuring these elements for tactical value will tells MOF the worth of implementing EA within MOF.

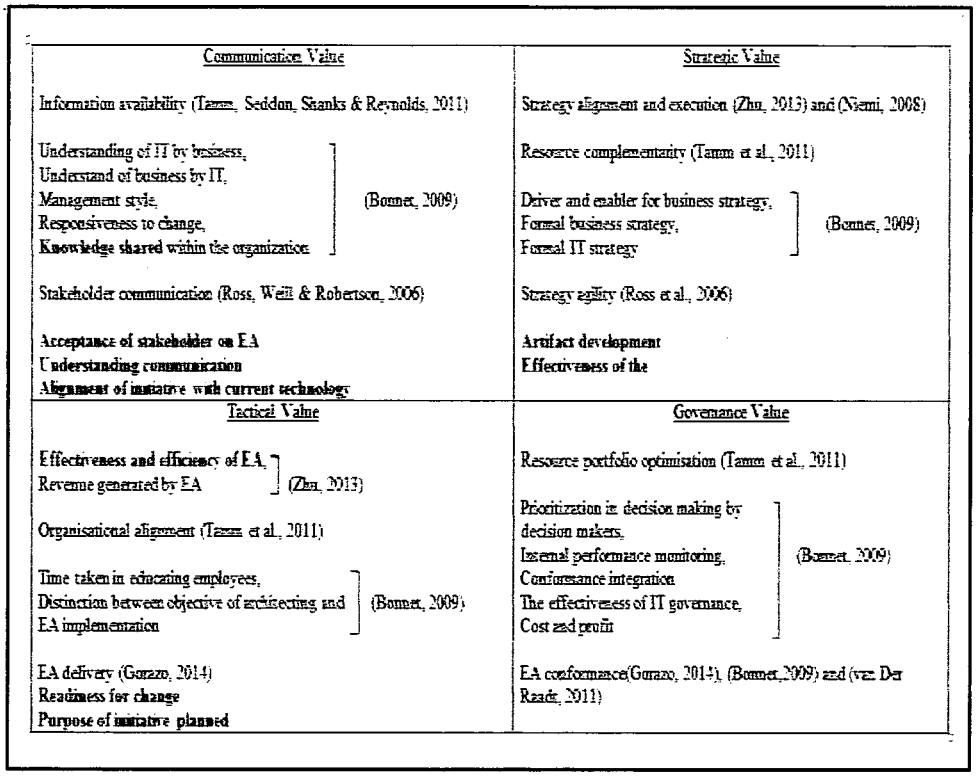


Figure 4.11 Synthesized model with filled tactical value

4.4.4 Elements of Governance Value

The elements in the governance value are; (Figure 4.12)

- Prioritization in decision making by decision makers.
- The effectiveness of IT governance.
- Innovation identification.
- Changes in MOF.

Prioritization in decision making and the effectiveness of IT governance shared the same elements from MOF to be measured. However, innovation identification differs from literatures reviewed. This element is different from literature as every organization has different goals to achieve, therefore innovation identified must be varied. By measuring the identification of innovation will enhance the EA practice of MOF that also will cause changes in the business process. Changes in MOF are measured for governance value. These elements require governance and holistic view that EA provides in order to execute successfully.

The elements from literature that that are synthesized with these elements are;

- Resource portfolio optimization

  MOF is still new in practicing EA, therefore any undocumented resources before implementing EA is needed to be documented for future business references if needed. Resource portfolio optimization will ensure the existing resources are parallel with targeted resources, this will ensure to minimize the performance gaps in the organization. Therefore, by measuring this element in MOF will assist in minimizing the performance gaps.

- Internal performance monitoring

  In order to monitor the internal performance in MOF, it requires to be viewed holistically. As EA provide holistic view for organization it will ease the internal performance monitoring. Hence, by measuring this elements will give the value of governance.

- Conformance integration and EA conformance

  The changes that occur in MOF are needed to be complied with EA concepts. The changes have to be integrated with the business process in ensuring the alignment of business processes with current technology. By measuring both of this elements will assist MOF in

conforming their EA practice with EA concept as well as for governance value.

These elements are described together because it relates with each other. The integration that happen due to current business process with EA need to be ensured that it comply with EA concepts.

- Cost and profit

  The flow of cost and profit can be seen by the governance of the organization. It requires holistic view in order to do so. EA is costly to be implemented. Therefore the ROI is expected to be worth the investment. The cost and profit in MOF need to be measured in order to realize the EA benefits and ensure the ROI is worth it.

The elements identified from literatures (Figure 4.7) are synthesized with the elements identified from MOF (Figure 4.8). The model of the synthesized elements for evaluating EA is in Figure 4.12.

Some of the elements identified from the interview conducted with BRM from MOF are similar with literature while some of it is not. The similarity of the MOF elements with literature is due to study MOF conducted is that they may refer to same literatures used in this research. While the elements identified from MOF does not included in the literature is may be due to different case study. This is because different organization may have different benefits to be realized (Niemi, 2008). Hence it creates different elements generated as it depends on the organization's business processes, mission and goal. Figure 4.12 shows the result of the synthesized elements from literatures as well as from MOF.

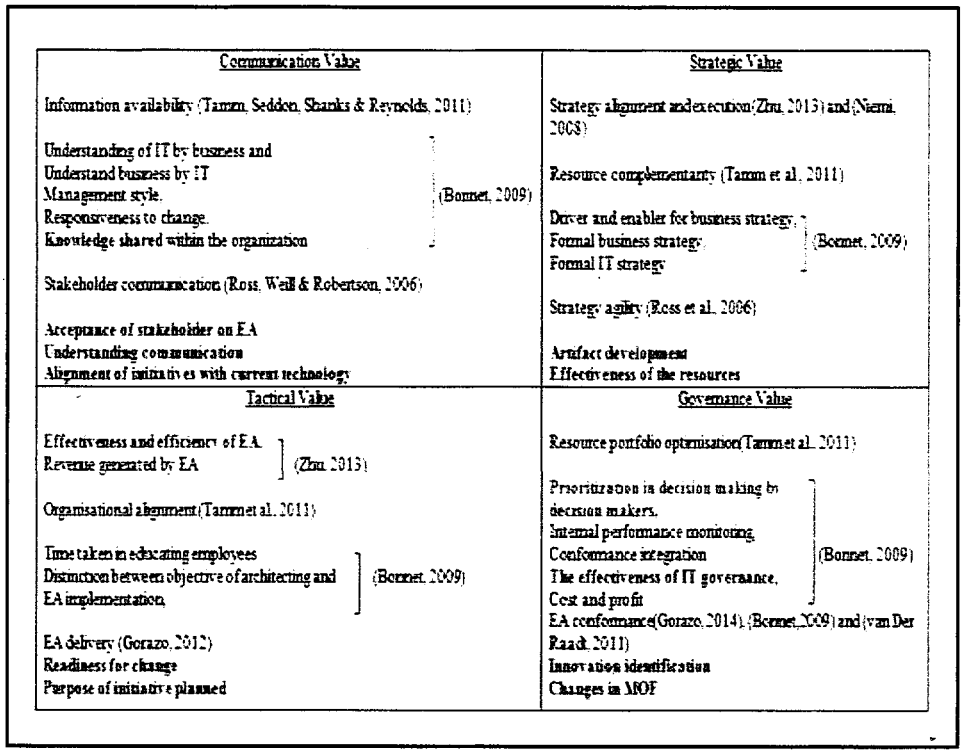


Figure 4.12 Synthesized model for EA evaluation

4.5 Summary

The findings of this research are explained briefly in this chapter. The activities mentioned in chapter three are carried out and the deliverables is seen in this chapter.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This chapter concludes the research by giving an overview of the study and presents significant findings found from the previous chapter. This chapter also discusses the limitation of this study and provides recommendation for future work.

5.1 Research Conclusion

It is stated by (Abd Razak, 2008) that EA is relatively new in Malaysia and the keen interest it gets from organization is overwhelming. This is because the benefits of EA are seen by the organization thus, attract organizations in adopting EA.

There are three objectives in this research; 1) A draft of an evaluation model in measuring EA based on literatures review, 2) Gathering and analyzing data from MOF, 3) To synthesize and construct and evaluation model in MOF. Each of this objective is carried out accordingly in order to get the outcome of this research which is to construct an evaluation model for measuring EA value based on the four benefit indicators for MOF EA practice. Models constructed consist of elements that need to be measured in order to realize the worth of each value.

The benefits of EA bring value to it, thus created questions when it is not realized. There are several reasons on why the benefits are not realized due to in-effectiveness of EA practice and poor knowledge regarding EA are being discussed in chapter 2. Therefore, measuring EA need to be done in order to see the worth of EA values. The set of possible measurements for EA is very large. This research analyzed the value of EA based on four benefit

indicators (Zhu, 2013) and (Tamm et al., 2011); communication value, strategic value, tactical value and governance value.

A case study on MOF is carried out. The interviewee is identified by understanding the role of EA stakeholder through knowledge acquisition. The results from the case study and literature review is synthesized to reflect the important components for each indicator. The final evaluation model is to assist the MOF for its next evaluation practice in measuring EA value.

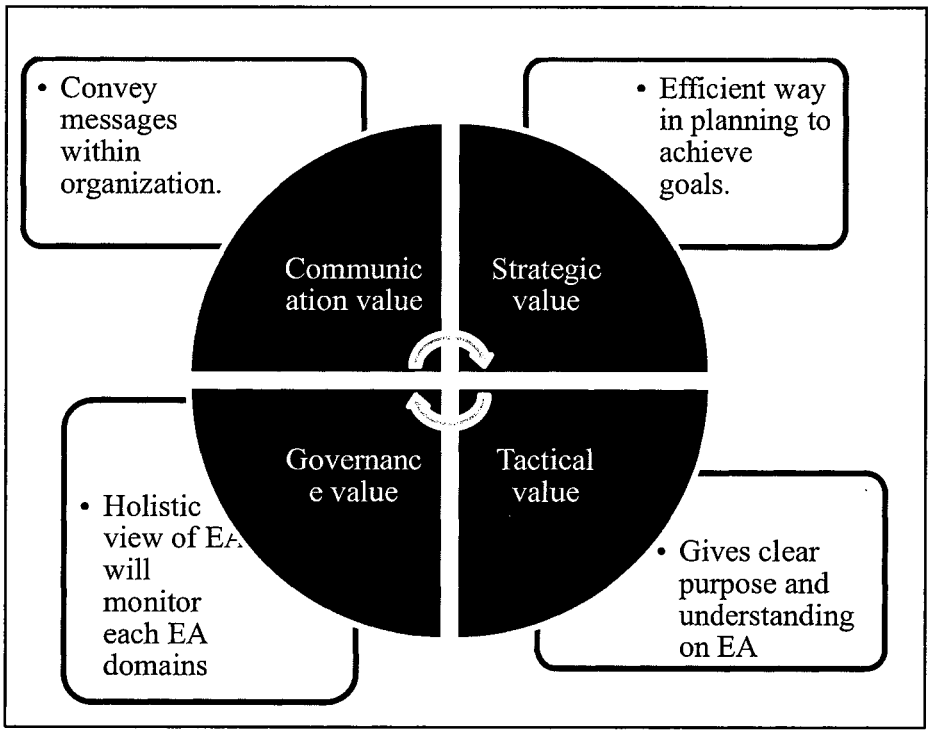


Figure 5.1 Benefit indicators (Zhu, 2013)

This research concludes that it is crucial to identify the measuring elements in order to realize the worth of EA values. The four values of the benefit indicators does relate with each other as shown in Figure 5.1. The communication value plays an important role in conveying messages and information among the stakeholders, ensuring EA is aligned with the business process of the organization as well as the effects of changes occur because of the evolvement of the environment is delivered well among the stakeholders

and the organizations. The strategic value shows the efficient way of EA to assist in strategizing the organizations planning in achieving its mission, vision and goals. The tactical value gives clear purpose and understanding on EA. With clear understanding will ease the stakeholder to practice EA within the organization hence, will realize the benefits of EA. The governance value will emphasize on the holistic view that is provided by EA. Each of EA domains will be monitor in order to see the changes that occur because of the evolvement of the economy with current technology.

5.2 Research Contributions

Studies on the benefits of EA are rarely being focused on, because it is believed that EA benefits differ for every organization (Niemi, 2008). The EA benefits need to be measured because it is the value hence, by measuring the worth of its value is known. The EA measurement is rather difficult to be carried out, because of the demanding effects as well as the changes that constantly happen in EA (Niemi, 2008). The EA measurement needed to be done in order to realize the EA benefits. There are various ways to measure EA, tools such as Balanced Scorecard is one of the ways in measuring EA.

In order to have an effective measurement, it is vital to identify on the elements to be measured. The contribution in this research is that an analysis and identification on the elements for measurement of EA is conducted, The elements are first reviewed and identified from literatures (refer Figure 4.7). A case study is chosen as MOF is the identified organization as they have EA practice and an interview session is conducted with BRM who is responsible in conveying information within departments as well as keeping update with changes occur in EA. From the data gathered, it is analysed. Elements for measuring EA in MOF are generated (refer Figure 4.8) and it is synthesized with the elements in Figure 4.7. The synthesized evaluation model (refer Figure 4.12) will assist MOF for their next EA practice evaluation.

5.3 Research Limitations

There are a few limitations in this research that should be taken into account when considering the findings.

- Limitation of the research as new inexperienced researcher. Research is time consuming with the need for critical understanding and analysis. This requirement for research process delays planned deliverables that caused reviewing a few times at the research schedule.

- Limitations such as time constraint are expected when working with a dateline. The time taken in waiting for case study feedbacks delayed the planned time for constructing evaluation model.

- The case study for this research is MOF. There are challenges in setting the appointment with the stakeholder. When no reply was received and the dateline for interviewing is up, a follow up to the MOF office was made. Finally an interview session was arranged but only 1 interviewee was available. Interviewing stakeholders who are busy is a challenge especially when setting up face-to-face interview.

- This research does not carry out an evaluation on EA practice in MOF. Poor knowledge in carrying out evaluation in organization limits this research to conduct an evaluation on EA practice using the elements in the synthesized model (refer Figure 4.12). Therefore the effectiveness of the elements cannot be measured.

5.4 Recommendation for Future Research

Since this research concluded by constructing an evaluation model that consist of elements that will measure for communication value, strategic value, tactical value and governance value. The elements are then mapped

with elements identified from MOF. However, there are recommendations that can be put into work that will eventually enhance and better this research;

- TTP is the department responsible in carrying out the evaluation on EA practice in MOF. Therefore they may use the synthesizing models for EA evaluation for MOF next EA practice.
- This research can be enhanced by including more elements from different case studies into the models. The model will be more advance because elements from each case study will vary. This is due to different organization have different benefits..

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APPENDIX

APPENDIX A: INTERVIEW QUESTIONS

LEVEL 1 (Introduction as the Role of stakeholder in EA implementation)

Question

1. What is your name?
2. Which department you working on?
3. What is your position in the organization?
4. Can you explain how you are exposed to EA?
5. What is your role in EA implementation?
6. How does your role affect EA implementation?
7. How do you define EA? Is it by process? Products?
8. What are the results? Principles? Models? Documents?
9. What are the benefits of EA?

LEVEL 2(Ask about current EA implementations, challenges faced)

7. What is your concern when you decide to implement EA?
8. In what level does your EA implementation are right now?
9. In what stages/levels/phases do you think it should be measured?
10. In what aspects that it should get measured?
11. What tools do you use when measuring EA?
12. What are your challenges for current EA measured practice?

LEVEL 3(Measurement Practice in EA in MOF)

16. Why is EA measured?
17. Can you explain to me what are being measured?
    Is it the process or products?
18. What are the elements being measured?
19. Who are involved during the EA measurement?
20. When does the measurement carried out?
21. How long does the measurement process take?
    Is it according to your EA planning?

22. Do you use some sort of Framework or models to carry out the measurement?
23. What are the results of the measurement?
24. What are the resources utilized during implementations?
25. Are the resources spent on measuring EA implementation worth it?
26. How did you use the result of measurement to improve EA?
27. Why do you think by measuring able to improve EA?
28. How do you value the measuring done is good?
29. What are your expectations when implementing EA?
30. What are the impacts of measuring EA to the EA practice from the stakeholder's perspective?